

# **SCIENCE AND MORMONISM 1: COSMOS, EARTH, AND MAN**



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# PREFACE

Daniel C. Peterson

John was silent for a few minutes. Then he began again:

“But how do you *know* there is no Landlord?”

“Christopher Columbus, Galileo, the earth is round, invention of printing, gunpowder!” exclaimed Mr. Enlightenment in such a loud voice that the pony shied.

“I beg your pardon,” said John.

“Eh?” said Mr. Enlightenment.

“I didn’t quite understand,” said John.

“Why, it’s as plain as a pikestaff,” said the other. “Your people in Puritania believe in the Landlord because they have not had the benefits of a scientific training. For example, I dare say it would be news to you to hear that the earth was round — round as an orange, my lad!”

“Well, I don’t know that it would,” said John, feeling a little disappointed. “My father always said it was round.”

“No, no, my dear boy,” said Mr. Enlightenment, “you must have misunderstood him. It is well known that everyone in Puritania thinks the earth flat. It is not likely that I should be mistaken on such a point. Indeed, it is out of the question.”

-C. S. Lewis<sup>1</sup>

I’ve long resisted the claim, typically (as in C. S. Lewis’s allegorical exchange between the pilgrim John and Mr. Enlightenment) assumed rather than explicitly argued, that no well-educated person, and certainly nobody with a solid grounding in modern science, can rationally choose to be a religious believer.<sup>2</sup> So I was delighted with the proposal that The Interpreter Foundation organize and sponsor a conference on the relationship between science and Mormonism. When

Dr. David Bailey called me regarding the possibility of such a conference, I jumped at the opportunity.

However, the genesis of that proposal emerged from Dr. Bailey's concern about an equal but opposite idea, more often implied than expressly stated — the idea that religious belief, and specifically Latter-day Saint belief, should regard science and scientists as adversaries. Dr. Bailey was worried by what he saw as a rising fear of science among Mormons.

To me there is little difference between the two ideas. Both regard Mormonism and modern science as fundamentally incompatible. They differ principally in the fact that one side hopes for the triumph of God-denying science over religion, while the other fears the evisceration of faith by Godless science. And both are wrong.

The papers in this volume come from the conference conceived in that telephone call, which was the first freestanding and independently-initiated conference of The Interpreter Foundation. We do not expect it to be our last.

I'm grateful to the conference organizing committee — David Bailey, Jeffrey M. Bradshaw, John S. Lewis, Gregory L. Smith, and Michael R. Stark. I regret that Drs. Lewis and Smith could not be with us at the event itself, in the Utah Valley Convention Center. Fortunately, though, technology didn't let us down, and Dr. Lewis was able to deliver his paper live from New Zealand.

I'm grateful to all those who accepted our invitation to participate and for the time they put into preparing their conference presentations and into finalizing their papers for this volume.

I also want to express my thanks for the contributions from [LDSAgents.com](http://LDSAgents.com) and FairMormon and for their continued support of Interpreter. I'm grateful, as well, to Tom Pittman, Bryce Haymond, and Sid Unrau for their efforts to make the conference visible, both on screens in the hall itself and, by streaming video, elsewhere. And to all those who helped with registration, collecting and sorting questions, and so forth. I can't name them all, and I fear to omit anybody. So this blanket expression of gratitude will have to suffice. It represents the only pay they received.

As with the other activities of The Interpreter Foundation and as with the Foundation itself, I continue to be impressed and even moved by the well-nigh miraculous way that this effort has come to fruition. (I would especially like to thank my friend and colleague Professor William Hamblin for his early work in helping to establish the Foundation.) We're still operating pretty much on a shoestring budget, with no institutional support, on the basis (almost entirely) of volunteer labor and expertise. I'm amazed by what has been accomplished so far — and there are more and even bigger things still on the horizon.

I close with a personal note:

I was very gratified that Interpreter was able to sponsor this particular conference for a very specific reason. In fact, I insisted that I be on the program, if only for a few minutes. Why? I've found myself described at various places on the web, repeatedly, as a young-earth creationist who hates and fears science, regarding it as demonic. (Compare Mr. Enlightenment, above, and his confidence about the supposed views of those in "Puritania.")

However, so far as I can recall, I've *never* been a young-earth creationist. *Ever*. I first arrived at BYU as an undergraduate mathematics major, with an interest in astronomy and cosmology. Admittedly, I soon went over to the dark side, pursuing degrees in Greek, philosophy, and, ultimately, Near Eastern languages, but my dissertation focused on an eleventh-century Arab Neoplatonist cosmology, so the interest never altogether faded, and I still take particular delight in roadside geology and in the history of astronomy and cosmology. In the interest of my own vindication, for the public record, I wanted it known that I believe in and value science.

More importantly, though, with others involved in The Interpreter Foundation and the conference, I hope that the papers of this volume strengthen faith, deepen understanding, and stimulate fruitful new thoughts.

### Endnotes

1. C. S. Lewis, *The Pilgrim's Regress: An Allegorical Apology for Christianity, Reason, and Romanticism* [1933] (Grand Rapids: Eerdmans, 1992), 20-21.
2. "Mormon Scholars Testify" is, in at least small part, a response to such a claim. See <http://mormonscholarstestify.org>.





# INTRODUCTION: SCIENCE AND MORMONISM

David H. Bailey  
Jeffrey M. Bradshaw

We often hear claims that science and religion are separate, incompatible domains waged in all-out war. For example, in a 2015 Pew Research Center survey, 59% of Americans say that science and religion are “often in conflict.”<sup>1</sup>

Yet the leaders of The Church of Jesus Christ of Latter-day Saints have rejected this notion from the beginning. As Brigham Young explained, “The idea that the religion of Christ is one thing, and science is another, is a mistaken idea, for there is no true religion without true science, and consequently there is no true science without true religion.”<sup>2</sup> He later elaborated on this point as follows, contrasting the LDS Church’s teachings on science with those prevailing among numerous other Christian denominations at the time:<sup>3</sup>

I am not astonished that infidelity prevails to a great extent among the inhabitants of the earth, for the religious teachers of the people advance many ideas and notions for truth which are in opposition to and contradict facts demonstrated by science, and which are generally understood. ... In these respects we differ from the Christian world, for our religion will not clash with or contradict the facts of science in any particular. ... [W]hether the Lord found the earth empty and void, whether he made it out of nothing or out of the rude elements; or whether he made it in six days or in as many millions of years, is and will remain a matter of speculation in the minds of men unless he give revelation on the subject.

In a recent study, Latter-day Saints (50%) were more likely than atheists or agnostics (13%), and than any other religious group surveyed (31-48%) to believe that science and religion can work together in collaboration.<sup>4</sup>

Another precept taught from early on in the Restoration — and also in sharp contrast to prevailing religious discourse at the time — is that God operates within the bounds of natural law rather than by contravening natural law. As Elder James E. Talmage, a twentieth-century Apostle, wrote:<sup>5</sup>

Miracles are commonly regarded as occurrences in opposition to the laws of nature. Such a conception is plainly erroneous, for the laws of nature are inviolable. However, as human understanding of these laws is at best but imperfect, events strictly in accordance with natural law may appear contrary thereto. The entire constitution of nature is founded on system and order.

Subsequent Presidents and General Authorities of the Church have advanced similar views about the ultimate compatibility of religious and scientific truths and, with notably few exceptions, have maintained markedly positive attitudes toward both the methods and conclusions of mainstream science and the advance of modern technology. As President Hugh B. Brown wrote:<sup>6</sup>

We should all be interested in academic research. We must go out on the research front and continue to explore the vast unknown. We should be in the forefront of learning in all fields, for revelation does not come only through the prophet of God nor only directly from heaven in visions or dreams. Revelation may come in the laboratory, out of the test tube, out of the thinking mind and the inquiring soul, out of search and research and prayer and inspiration.

Similarly, President Ezra Taft Benson said:<sup>7</sup>

Religion and science have sometimes been in apparent conflict. Yet the conflict should only be apparent — not real — for science should seek truth, and true religion is truth. There can never be conflict between revealed religion and scientific fact. That they have often occupied different fields of truth is a mere detail. The gospel accepts and embraces all truth; science is slowly expanding her arms and reaching into the invisible domain in search of truth. The two are meeting daily — science as a child, revealed religion as the mother. Truth is truth, whether labeled science or religion. There can be no conflict. Time is on the side of truth — for truth is eternal.

### **What can be said about the professional participation of Mormons in science and academia?**

In the 1990 listing of 120,000 individuals in *American Men and Women of Science*, “Utah stood 21 percent above the second place state, which was Delaware.”<sup>8</sup> This was despite the fact that there were more Mormon scientists outside of Utah and Idaho than inside, that practicing Mormons no longer constituted the majority population in Utah, and that there has been an increase in the overall orthodoxy of Mormon scientists. Noel B. Reynolds reports his informal observation that: “The overwhelming majority of LDS academics and intellectuals are active, faithful Latter-day Saints.”<sup>9</sup>

Such findings about LDS scientists are consistent with other studies affirming an exceptional proportion of Mormons in American university faculties across all disciplines. A major survey published in 2007 reported that while non-LDS “Christians are underrepresented among faculty,” Mormons are “overrepresented compared to the general public.”<sup>10</sup>

The reasons for the attraction of science and academia for members of the Church have not received the formal study they deserve. However, BYU professor and administrator Noel B. Reynolds offers a personal opinion on the matter:<sup>11</sup>

In spite of occasional eruptions of anti-intellectualism in the LDS community, the long-term reality has been that Mormons, perhaps more than any other religious group, seek and respect learning. Joseph Smith set the example himself, establishing schools for adults and studying biblical languages. The LDS community has always produced far more than its share of highly educated people, ... [and in the LDS community] the more educated a person is, the more likely he or she is to be fully observant and faithful.<sup>12</sup>

There may be good reasons for this surprising characteristic of the Latter-day Saints. Mormonism is a religion of both the spirit and the intellect. Mormon missionaries tell their investigators that they have answers to the great human questions. Conversion stories are always stories of learning and inspiration. ... Mormonism is not a religion that tells its members they have no right to know the divine mysteries. Rather, it tells them to seek knowledge of all things. There is nothing that God is not willing to reveal to his children, even to the point of showing himself to them on special occasions.

In line with what Reynolds expresses above, Elder Neal A. Maxwell wrote: “For the disciple of Jesus Christ, academic scholarship is a form of worship. It is actually another dimension of consecration. Hence one who seeks to be a disciple-scholar will take both scholarship and discipleship seriously; and, likewise, gospel covenants.”<sup>13</sup> Gerald Stott similarly concludes from his research that “Latter-day Saint theology appears to negate the secularizing impact of education by sacralizing it.”<sup>14</sup>

### **What do American academics and scientists think of religion in general and Mormons in particular?**

In 2013-2014, Rice University sociologist Elaine Howard Ecklund conducted the largest study to date of American views on religion and science, including a nationally representative survey of 10,000 Americans along with over 300 in-depth interviews with Christians, Jews, and Muslims. She found that the size of the segment of American scientists characterizing themselves as “very religious” and engaged in some key traditional religious practices — though different from the public at large — was still in the same general ballpark. Roughly 18% of the scientists in her sample attended weekly religious services, compared with 20% of the general population; 15% considered themselves “very religious,” compared with 19% of the population; 13.5% read some religious text weekly, compared with 17% of the population; and 19% prayed once or more per day, compared with 26% of the population.<sup>15</sup>

Although Ecklund’s survey revealed that the sizable segment of U.S. scientists involved in religious practice and identifying themselves as “very religious” was not too different from the general public, another segment of scientists described themselves as indifferent to religion and skeptical of a belief in God. In a study

of university faculty published in 2007, 75% of the sample said that religion was not important to them.<sup>16</sup> Only about 36% of scientists have no doubt about God's existence, compared to 55% of the general population.<sup>17</sup> However, it still should be recognized that 36% represents a significant segment of American scientists.

In the 2007 study previously mentioned, 53% of university faculty surveyed held unfavorable views of evangelical Christians, "leading Mormons as the least liked religious group by 20%."<sup>18</sup> Notably, faculty opinion about the LDS tended to be much more polarized than that of the general public, with significantly fewer reporting neutral feelings (20% vs. 42% of the general population) and 40% (vs. 33%) reporting favorable feelings.<sup>19</sup>

One of the possible reasons for such polarization is suggested in a 2007 poll of the general public. The results revealed that "having an acquaintance who is Mormon is linked with more positive opinions of Mormons and Mormonism. The large majority of those who know a Mormon (60%) express a favorable view of Mormons, compared with fewer than half (44%) of those who do not personally know a Mormon. And those who are acquainted with a Mormon are 11 points more likely than others to say that Mormonism and their own religion have a lot in common."<sup>20</sup>

### **Why might many thoughtful people be disinclined to take religion seriously?**

Among the reasons for this state of affairs is the fact that popular religious understanding often solely "rests on a caricature of religious fundamentalism" which is seen "as a reactionary movement bent on reversing all the progressive measures achieved over the last ... decades."<sup>21</sup>

In addition, many scientists who consider themselves spiritual (comprising 51% of the believers, 27% of the agnostics, and 22% of the atheists<sup>22</sup>) reject institutional religion because of its deep dependence on authority as a primary source of truth (e.g., church leaders, scriptures). "Spirituality," according to Ecklund's study, "has more potential to align with scientific thinking and reasoning" because it is "open to being shaped by personal inquiry."<sup>23</sup> The study also elaborates on reasons why, for many scientists, science trumps religion of any sort:<sup>24</sup>

When scientists take the norms they perceive as governing science and apply them to all of life, religion is weighed against science, and it does not measure up. Religious views are not based on the kind of information that can be judged impartially, such scientists would argue. There is a personal bias in religion; religious individuals have a stake in findings that support their faith (they lack the disinterest that scientists have). These scientists ... compare all religion to science and find it wanting.

Scientists who have this view think that in all spheres of life, only knowledge that is found through science is reliable. Likewise, for them, only questions answerable

through science are worth exploring. Questions concerning the *meaning* of life are not even worth asking.

Some scientists have become disenchanted with religion because of experiences similar to non-scientists. These include negative encounters with leaders and teachers who have dismissed or ridiculed their sincere questions, unsatisfying struggles with the problems of evil and pain in a world that religion claims is created and managed by God, and what are perceived as harmful social and political consequences of some religious beliefs and practices.<sup>25</sup>

Moreover, as fewer people in America than ever before are being raised in homes where religion is regularly discussed and practiced, many of the influences and much of the knowledge of religion formerly obtained in childhood are waning.<sup>26</sup> It is not surprising that many people today simply don't connect with religion, since they may not have anyone in their family or close circle of acquaintances who is at all religious.<sup>27</sup> In such cases, their perspective may be shaped in large measure from current events noteworthy enough (i.e., extreme or unusual) to make the daily news or humorous enough to be remembered and repeated. Data points of this sort provide little insight on the lives and views of the more typical believer.

According to sociologist Rodney Stark, thoughtful people may be put off from religion in knowing "that many illusory or even fraudulent religious claims have been advanced" over the course of history.<sup>28</sup> Moreover, "comparisons among religions can easily be corrosive to faith because one must confront the fact that, since they disagree, not all religions can be entirely true. From there it is a small step to conclude that all religions are false, that 'all are refuted by all,' as the renegade monk Jean Bodin put it in 1593."<sup>29</sup> Conversely, "similarities among the world's religions ... [sometimes may be] taken as 'proof' that they all are human inventions."<sup>30</sup> Finally, some people are swayed by arguments that religious belief is nothing more than a combination of biological, psychological, and/or cultural imperatives.

While ultimate satisfaction of such concerns cannot be obtained by reasoned argument alone, perhaps at least a few fallacies can be swept aside. First, no serious believer would hold that each of the sundry, contradictory collections of spiritual beliefs and practices held at one time or another by individuals are rooted in divine revelation. "Some revelations are of God," the Prophet Joseph Smith is remembered as saying, "some revelations are of man: and some revelations are of the Devil."<sup>31</sup>

Moreover, it should not be forgotten that even authentic revelations may be "subject to misunderstanding, exaggeration, and faulty transmission."<sup>32</sup> Regarding religious similarities among diverse groups, many believers are prepared to accept the possibility that "authentic revelations underlie many of the major faiths."<sup>33</sup> Finally, with respect to the "insufficiency of all biological approaches to explaining religion, or any other aspects of human culture," the most important consideration in Stark's view "is that they are unnecessary! The fundamental biological basis of all culture is general intelligence, and nothing more needs to be postulated."<sup>34</sup>

“Thus,” writes Stark, “we reach the fundamental question: Does God exist? That is, have we discovered God? Or have we invented him? Are there so many similarities among the great religions because God is really the product of universal wish fulfillment? Did humans everywhere create supernatural beings out of their need for comfort in the face of existential tragedy and to find purpose and significance in life? Or have people in many places, to a greater and lesser degree, actually gained glimpses of God?”<sup>35</sup> Once the possibility of authentic divine revelations is granted, attention can be turned to the “immense and humbling challenge” of determining “which ones are valid.”<sup>36</sup>

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and London, England: Latter-day Saints Book Depot, 1853-1886. Reprint, Salt Lake City, UT: Bookcraft, 1966.

### Endnotes

1. C. Funk et al., Religion and Science. A 2013-2014 study by Ecklund concluded that “27 percent of Americans feel that science and religion are in conflict” (E. H. Ecklund, *Religious Communities*, p. 16. Cf. R. David, Misconceptions). According to the same study, nearly 20 percent of the general population and 22 percent of scientists think that religious people are hostile to science, and nearly 22 percent of the general population think that scientists are hostile to religion (E. H. Ecklund, *Religious Communities*, pp. 17-18. Cf. R. David, Misconceptions). That said, in Ecklund’s large 2005-2008 study of science and religion, she found only “five (!) of the atheist scientists [she] talked to were so hostile that they were actively working against religion” (E. H. Ecklund, *Science vs. Religion*, p. 150).
2. B. Young, 3 May 1874, p. 52.
3. B. Young, 14 May 1871, pp. 115-117.
4. E. H. Ecklund, *Religious Communities*, p. 16.
5. J. E. Talmage, *Articles of Faith*, p. 20.
6. H. B. Brown, *An Abundant Life*, p. 138.
7. E. T. Benson, *In His Steps*, p. 546.
8. R. T. Wooton, *Saints*, p. 58.
9. N. B. Reynolds, Preface, p. x.
10. G. A. Tobin et al., *Religious Beliefs*, p. 20. Other groups specifically noted as being overrepresented were Jewish faculty, faculty espousing atheism or no religion, and Buddhist faculty (ibid). Similar results were found in Ecklund’s 2013-2014 study, which ranked proportions of scientists in various religious traditions as follows: Muslims/Hindus/Buddhists/Sikhs/Jains (13.7%), Jews (10.1%), Atheists/Agnostics/No Religion (7.7%), Mormons (4.6%), Mainline Protestants (4.5%), Catholics (3.9%), and Evangelical (3.6%) (E. H. Ecklund, *Religious Communities*, p. 9).
11. N. B. Reynolds, Preface, pp. x-xi.
12. While national data indicate that, overall, the most educated are the least religious, among some denominations — and most dramatically among Mormons — a strong positive correlation has been reported. “Highly educated Mormons are more likely to pray frequently, to have strong religious beliefs and to attend meetings, suggesting that devotion is even more important for



those with higher levels of education than those with lower educations” (S. L. Albrecht et al., *Secularization*, p. 308). This is due at least in part to the fact that from its very beginning, the Church has placed significant emphasis upon education. “One result of this has been a standard of educational attainment that is significantly higher than the national average. ... For both males and females, the percentage of Mormons who have completed post-high-school education is significantly higher than is the case for the [U.S.] population as a whole. For Mormon males, 53.5 percent have some post-high school education compared to 36.5% for the U.S. population. For females, the figures are 44.3 for Mormons and 27.7 for the U.S. population generally” (ibid., p. 302). That said, “the results are not consistent across college majors (philosophy and religion majors do not fare well in maintaining ‘high orthodoxy,’ for example)” (T. L. Givens, *Paradox*, p. 238, citing Armand Mauss) — though it is possible that LDS students fare better in religiosity than students with such majors from other Christian denominations.

13. N. A. Maxwell, *Disciple-Scholar*, p. 7.
14. G. Stott, *Effect*, p. 52. See also T. L. Givens, *Paradox*, pp. 65-99, 195-240; J. W. Welch, *Thy Mind*.
15. E. H. Ecklund, *Religious Communities*, p. 11; D. Ruth, *Misconceptions*.
16. G. A. Tobin et al., *Religious Beliefs*, p. 12.
17. E. H. Ecklund, *Religious Communities*, p. 11; D. Ruth, *Misconceptions*. In a different study by Ecklund conducted in 2005-2008 (E. H. Ecklund, *Science vs. Religion*) that included 1,700 natural and social scientists at elite universities (a much more narrowly defined and less religious set of scientists than the ones sampled in the 2013-2014 study), results were significantly different. In this earlier study only “about 64 percent of scientists at elite research universities either are certain that they do not believe in God, the classic atheist position, or they do not know whether or not there is a God, the classic agnostic view,” compared to about 6 percent of the general public (ibid., p. 16). Put another way, “only 9 percent of scientists say they have no doubt that God exists, compared to well over 60 percent of the general public.” Of course, “agnosticism may mean something different to scientists than it does to members of the general public. By definition, their life-work of science requires insurmountable evidence. ... A scientist is rarely absolutely convinced about anything!” (ibid., p. 36). That said, 71 percent of scientists were willing to grant that there are basic truths in many religions (ibid., p. 35).

Results of religious surveys can be appreciated fully only if a nuanced view is taken of the findings. For example, Ecklund’s survey found that nearly 50% of American scientists identify with a religious label, compared to 84% of the general population (ibid., p. 33). However, of those who believe, “the highest proportion are Jewish (about 16 percent), but many of these identify as Jewish as

an ethnicity, not in terms of an active religious faith” (ibid.). This is why nearly 50% of scientists surveyed could identify themselves with a religious label, even though 64% declared themselves to be atheists or agnostics.

18. G. A. Tobin et al., *Religious Beliefs*, p. 12.
19. A September 2007 Pew opinion poll (Public Expresses Mixed Views of Islam, Mormonism), taken of the general American public following a period of greater visibility of Mormonism during the Mitt Romney presidential campaign, gave the following Favorable-Unfavorable-No Opinion breakdowns: Jews (76-9-15%), Catholics (76-14-10%), Evangelical Christians (60-19-21%), Mormons (53-27-20%), Muslim Americans (53-29-18%), Muslims (43-35-22%), Atheists (35-53-12%).
20. Public Expresses Mixed Views of Islam, Mormonism.
21. C. Lasch, *Revolt*, p. 215. E. H. Ecklund, *Science vs. Religion*, pp. 153-155. See also D. Kinnaman et al., *Unchristian*. The authors of this book are evangelical Christians who think that it’s important to understand some of the stereotypes (all admittedly having some basis in reality) that people of the Mosaic (born 1984-2002) and Buster (born 1965-1983) generations have of religion. Some of the chapters are entitled: “Hypocritical,” “Get Saved!,” “Antihomosexual,” “Sheltered,” “Too Political,” and “Judgmental” — thus making clear many of the issues that make it difficult for religion to get a serious hearing among some people today.
22. E. H. Ecklund, *Science vs. Religion*, p. 58.
23. Ibid., p. 56.
24. Ibid., p. 17. For example, Robert T. Pennock writes (R. T. Pennock, *Tower*, pp. 178, 179):

To the faithful, having faith means sustaining belief despite the lack of [observable] evidence and sometimes even in the face of countervailing evidence. This accounts for the difference between a scientific test of a hypothesis and a theological test of faith. In the former case, we believe a proposed hypothesis only because it is supported by [observable] evidence and has survived attempts to disconfirm it [through the scientific method], and we reject it if the evidence opposes it. In the latter case, to survive a test of faith means to hold fast to one’s belief even when everything goes against it. ... [S]cience, far more than any of its specific conclusions, is fundamentally scientific method. Creationists would have us turn science on its head and replace scientific reasoning based on observable evidence with human interpretations of revealed truth. The confusion of human languages would be nothing compared to the great confusion that would result from such a program.

25. See *ibid.*, pp. 20-24. In an article in *The Instructor*, for many years the Church's magazine for teachers, we read (E. L. Poulsen, *Make Your Teaching*, pp. 179, 199):

The Sunday School teacher who makes a pastime of ridiculing men of science, and of holding them up as the arch enemies of religion, usually loses the respect of the most intelligent members of his class. Others, who for the time being accept his conclusions, are forced later on to believe they must choose one or the other. Sometimes, they don't choose religion. And if they don't, the deceptions of unscrupulous and irreligious teachers of science may have been one of the causes; but it's equally true that the Sunday School teachers themselves may have been the worst offenders.

Little good comes from overstressing immature, childish versions of the creation, or from castigating unpopular political and economic theories, though this sort of thing is frequently done. Perhaps such a tendency is the second line of defense for those teachers who find themselves facing their classes without adequate preparation for the lesson at hand.

Many notable men and women, as everyone knows, have given the Sunday School credit for successfully laying the spiritual foundations of their lives, or of guiding them through periods of doubt and uncertainty when they were wavering. ...

There are safeguards, however, with which the Sunday School teacher can surround himself so that he will almost certainly be able to inspire youth. The first of these is humility. Nothing so completely disarms an opponent or softens the edge of an argument as the removal of all sham and pretense from one's character, revealing a mind willing to learn, and eager to enlarge its own horizons, and a heart beating with good will for every individual God has created.

26. See *ibid.*, pp. 24-26.

27. Some years ago in Edinburgh, the city of the common sense philosophers where Charles Darwin's interest in natural history had budded, where his father and uncle and grandfather had studied before him, and where Elder Orson Pratt poured out his soul in discouragement on the top of Arthur's Seat for the Lord to give him just 200 Scottish converts (J. B. Allen et al., *Men*, pp. 163-164), Bradshaw remembers having lunch with a few colleagues:

The topic of religion came up, and though the comments were derisive, I held my peace for the moment. Later, sitting with the faculty on the hard wooden pews of the 300-year old chapel waiting for a lecture to begin, an opening came for me to share the fact that I was an active member of the LDS Church with a friend seated to my left. In shock, the friend expressed his sincere apologies for his comments at lunch. He said that the idea that I was a believer had never occurred to him, that there was only one other person he knew at work who had any kind of religious belief, that both he

and his wife were both raised without any religion, as were their parents before them. Once rare, this situation has become commonplace.

28. R. Stark, *Discovering*, p. 8.

29. *Ibid.*, pp. 1-2.

30. *Ibid.*, p. 2.

31. Cited in D. Whitmer, *Address*, p. 31; cf. J. Smith, Jr., *Teachings*, 16 May 1841, p. 189. See also B. H. Roberts, *Comprehensive History*, 1:162-163; J. Smith, Jr. et al., *Manuscript Revelation Books, Facsimile Edition*, Canadian Copyright Revelation, circa early 1830, BCR 30-31, pp. 31, 33.

32. R. Stark, *Discovering*, p. 52.

33. *Ibid.*, pp. 2-3.

34. *Ibid.*, p. 43.

35. *Ibid.*, p. 20.

36. *Ibid.*, p. 8. See, however, the findings of Guy Consolmagno, who concluded from his interviews that while younger scientists and engineers often saw religion as a source of truth, older ones, already settled in what they believe, tended to see it principally as a source of community (G. Consolmagno, *God's Mechanics*, pp. 102-118).

# SCIENCE VS. RELIGION: CAN THIS MARRIAGE BE SAVED?

David H. Bailey

The methodology of modern science has been remarkably successful in uncovering the workings of the Earth and universe about us. Just in the past half-century, science has unlocked the code of life and read the DNA of many organisms, traced the history of the known universe, discovered a set of mathematical laws that explain virtually all physical phenomena with remarkable precision, and laid the foundation for astounding advances in technology.

One look at a modern smartphone, which packs computer power and memory exceeding that of the world's most powerful supercomputer just twenty years ago together with a dazzling facility for gathering data and communicating around the world, and one begins to appreciate the progress that has been achieved. Even greater advances are in store for the future: a manned mission to Mars is likely within the next decade or two as is the advent of personalized, DNA-based medicine and countless other advances that haven't yet been conceived.

Thus it is increasingly clear that any movement that opposes the progress of modern science will be soundly rejected by much of modern society.

On the other hand, religion plays a similarly important foundation in the lives of the vast majority of people worldwide. According to a recent study, over 92% of Americans (including, amusingly enough, 21% of self-described atheists and 55% of self-described agnostics) affirm some belief in God. What's more, 39% of Americans (including 37% of atheists and 48% of agnostics – more than the population at large) say that they experience a “deep sense of wonder about the universe” on at least a weekly basis (Pew, 2008). One of my scientific colleagues — who has not practiced conventional religion for many years — nonetheless acknowledged that with regard to the magnificence of the universe and the elegance of natural laws that govern it, he is a “devoted worshipper.”

Religion has indisputably inspired some of the world's greatest art and literature, as is evident from even a casual stroll through any of Europe's great art museums. The Book of Job's remarkable search for meaning in suffering has few peers in world literature (Norwegian, 2011). Religious motifs pervade the works of Shakespeare, especially marquee plays such as *Macbeth*, *Hamlet* and *Othello*. Johann Sebastian Bach, who composed over a thousand pieces of sacred music, is today widely regarded as the greatest composer in history, and his Mass in B-Minor is thought by many to be one of the greatest single works of music in the classical repertoire (Tommasini, 2011). Similarly, Victor Hugo's intensely religious *Les Misérables* is widely regarded as one of the greatest novels of all time and in our own day spawned both London's longest-running musical theater production and an enormously popular full-length film.

Even more important, religion has played an enormous role worldwide as a governor of moral conduct through the ages. In their 1968 book *Lessons of History*, Will and Ariel Durant wrote, "Even the skeptical historian develops a humble respect for religion, since he sees it functioning, and seemingly indispensable, in every land and age. ... There is no significant example in history, before our time, of a society successfully maintaining moral life without the aid of religion" (Durant, 1968, pp. 43, 51). In our own time, well-known skeptic Michael Shermer, after reviewing tragedies in the name of religion, nonetheless acknowledged, "However, for every one of these grand tragedies there are ten thousand acts of personal kindness and social good that go largely unreported in the history books or on the evening news. Religion, like all social institutions of such historical depth and cultural impact, cannot be reduced to an unambiguous good or evil" (Shermer, 2000, p. 71).

Thus it is clear that any movement that opposes modern enlightened religion will be soundly rejected by much of modern society.

In this light, it is clear that science and religion must work together. As Hugh B. Brown of the LDS First Presidency in the 1960s and 1970s once explained, "Peace and brotherhood can be achieved when the two most potent forces in civilization — religion and science — join to create one world in its truest and greatest sense" (Brown, 1999, p. 139).

### **The "War" Between Science and Religion**

Unfortunately, beginning in the early twentieth century but with greater intensity in the past decade or two, a battle is being waged between two camps loosely representing "science" (actually, certain atheistic scholars and scientists) and "religion" (actually, certain creationists and religious fundamentalists — mostly not of the LDS faith).

There are some misconceptions about the historical roots of this battle. Many presume that the conflict had its roots in the dispute between Galileo and the Catholic Church in the 1600s, blossoming into full-scale war in the 1800s, and has



*Galileo Before the Holy Office of the Vatican in 1633, 1847. Joseph Nicolas Robert-Fleury, 1797-1890*

continued unabated since. Whereas there is some truth to this, in reality the history is not so simple.

To begin with, Galileo himself was not without fault in his dispute with the Catholic Church. His opus *Dialogue on Two World Systems* placed the traditional cosmology in the mouth of Simplicio (“simpleton”), which was hardly a diplomatic way to present his views to papal authorities. Even so, his punishment (house arrest in Florence) at the hand of Church authorities was very mild for the times. In any event, in 1757 Pope Benedict XIV formally ended the ban on heliocentric cosmology, so it was thereafter not an issue. Similarly, in the nineteenth century, although there was significant discomfort with old-earth geology and Darwin’s theory of evolution as these theories unfolded, by the end of the century theologians of major denominations had largely made their peace with modern science, at least in a general sense. Even William Jennings Bryan, who argued the case against Scopes in the Scopes trial of 1925, agreed that the days of creation might well be millions of years in duration (Numbers, 2009, p 183).

It is also important to note that modern science arguably had its roots in Judeo-Christian monotheism. Some present-day scholars wonder aloud whether modern science would ever have developed in the absence of Judeo-Christian monotheism (see below). Further, many leading scientists throughout history were persons of religious faith, often connected closely to mainline Christian churches. Gregor Mendel, who discovered the genetic basis for biology, was an Augustinian friar. Georges Lemaitre, who was the first to promulgate the expanding universe and big bang cosmology, was a Jesuit priest. And even those scientists who rejected some aspect of Judeo-Christian theology often retained a fundamental faith. Isaac

Newton wrote more on theology and the Bible than he did on mathematics and physics, although he became convinced that modern Christianity had deviated from original Christian theology. Charles Darwin rejected organized religion but concluded his *On the Origin of Species* by exulting: “There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved” (Darwin, 1859, p. 490). And Albert Einstein, who rejected conventional Judeo-Christian monotheism, nonetheless declared that the “cosmic religious feeling” was the “strongest and noblest motive for scientific research” (Einstein, 1930, p. 39).

Thus while the overall tension between science and religion may extend back for centuries, the consensus of historians is that the present conflict dates back to roughly the 1920s, partly in reaction to the Scopes trial and the publicity that ensued (Numbers, 2009). The writings of Seventh-day Adventist George McCready Price are often mentioned here. In 1902 he argued that much of modern science is “in the highest degree improbable and absurd” (Price, 1902, p. 69) and in the process laid the foundations for what is now known as “creationism” or “creation science” (Price, 1923). Whitcomb and Morris’ 1961 influential work *The Genesis Flood* gave additional impetus to the movement. These authors argued, as did Price, that since the scriptures clearly describe a creation over six literal days and a universal flood, Christians have only two choices: reject God’s inspired Word or reject modern science. So they offered instead an alternative view that rejected much of modern science (Whitcomb, 1961).

In subsequent decades of the twentieth century, many in the Protestant world in particular were drawn to this worldview, in part to counteract the increasing dominance of modern science, which was underscored by the advent of nuclear energy, color television, DNA, big bang cosmology, and the Apollo moon landing. Then, beginning in roughly 1970, numerous religious organizations began to promote material based on the works mentioned above for public school curricula. Most of these attempts were subsequently blocked by court rulings, but battles continue to the present day, leaving a legacy of tension and distrust (Rich, 2013).

In the wake of the battles over school curricula and the like, not to mention tragedies such as the 9/11 attacks, numerous scientists and secular scholars became similarly polarized in their views and more vocal in the public arena. Best known among these writers are the “New Atheists,” namely Richard Dawkins, Daniel Dennett, Samuel Harris, and Christopher Hitchens. Not content merely to promote science education and defend science against pseudoscience, they have attacked religion as both irrational and harmful. Their books and articles have been widely read and are considered by many to be the canonical view of religion by modern science.



Not surprisingly, all of this has led to widespread perception of all-out war between science and religion, requiring one to choose a certain side and reject the other. Many scientists with religious faith live double lives, not mentioning their religious beliefs to their colleagues. Many college students and adults experience crises of religious faith because they have heard only this all-or-nothing rhetoric from the two warring parties. Moderate voices are seldom heard.

So is it true that the choice is between one extreme or the other? Can this marriage be saved?

### **The War Between Science and Religion: Camp A**

Personally, I do not like the labels “science” and “religion” here, since many prominent scientists reject the rhetoric of the first group, and many prominent religious leaders, including some LDS leaders, reject the rhetoric of the second group. So for the purposes of this discussion, hereafter they will be denoted “Camp A” and “Camp B,” respectively. We will examine each camp in turn.

As mentioned above, the best known Camp A writers are four authors known loosely as the “New Atheists,” namely Dawkins, Dennett, Harris, and Hitchens (Dawkins, 2006; Dennett, 2006; Harris, 2006; Hitchens, 2007), although several other writers could be listed as well. Camp A writers typically hold that religion is fundamentally irreconcilable with modern science and reject essentially all modern religions as irrational. They also insist that science is the only route to truth and that all religious precepts, including the existence of God, must be tested scientifically and rejected if found wanting. Some of these writers highlight the history of religious wars through the ages as evidence that religion is fundamentally harmful. They also blame religion for many of society’s ills.

One of these writers, in a single breathtaking sentence, decried religion as “violent, irrational, intolerant, allied to racism, tribalism, and bigotry, invested in ignorance and hostile to free inquiry, contemptuous of women and coercive toward children” (Did he leave anything out?) (Hitchens, 2007, p. 56). In a similar vein, a prominent biologist asked us to imagine “a world with no religion, ... no suicide bombers, no 9/11, ... no persecution of Jews as ‘Christ killers,’ ... no shiny-suited, bouffant-haired televangelists fleecing gullible people of their money” (Dawkins, 2006, pp. 23-24). Several of these writers emphasize that this conflict is an all-or-nothing matter: “Science could not be more different (than religion)” (Gee, 2013); “Indeed you must check your brains at the (church-house door)” (Provine, 1988).

Religious scholars who have analyzed the writings of the Camp A writers have identified significant flaws in this literature (Haught, 2008; Ward, 2008; see also Bailey, 2013a). To begin with, Camp A writers are often blustery in tone, as can be seen from above, as if the victory of the war between science and religion would go to the side that shouts the loudest. Such rhetoric is unbecoming of serious scholarship, and if included in a manuscript submitted to a research journal would be cause



*Taking of Jerusalem by the Crusaders, 15 July 1099, 1847, Emile Signol, 1804-1892*

for quick rejection. Also, Camp A writers typically highlight statements made by a few rather dogmatic religious figures (the straw man approach), then presume all who are partial to religion are of the same mindset. Finally, they ignore or dismiss the many positive social values of religion as have been highlighted in numerous historical and social studies.

Some of the Camp A criticisms must be granted. For example, their assertions that religion has often led to armed warfare are, of course, quite correct. Hundreds of thousands died in the crusades of 1095-1291. Between two and four million died during the French religious wars of 1562-1598. Between three and twelve million died in the Thirty Years' War (1618-1648), which was fought between Protestants and Catholics in what is now Germany. Hundreds of thousands were tortured or killed by the Inquisition and in similar persecutions by Protestants. Millions of Jews died in the Holocaust of the 1940s. Historians Will and Ariel Durant, after reviewing this history, solemnly declared, "(W)e must rank the Inquisition, along with the wars and persecutions of our time, as among the darkest blots on the record of mankind" (Durant, 1975, vol. 4, p. 784).

Horrible as these conflicts were, however, the consensus of present-day historians is that the wars of the Reformation, for example, were only partially due to religious differences. Just as important was the desire of northern nation-states to assert independence from Rome's centuries-long hegemony over Europe (Durant, 1975, vol. 6, pp. 935-940). These conflicts also must be weighed in context with secular conflicts of the same general time period, many of which were even worse. Thirty-six million, roughly one-sixth of the world population at the time, died in the An Lushan Rebellion of China during the eighth century (Pinker, 2011, pp. 194-195). Between 30 and 60 million died in the Mongol conquests of central

and eastern Asia during roughly 1200 to 1500. Between 3.5 and 6.5 million died in the Napoleonic Wars. Between twenty-three and sixty-five million died in World War I, and between forty and seventy-two million died in World War II. Finally, between twenty and thirty million perished in the Chinese Cultural Revolution from 1966 to 1976. Religion was not a significant factor in any of these conflicts.

It is worth pointing out, contrary to the claims of some of the Camp A writers, that secular and atheistic movements have also wreaked considerable havoc throughout history. In the 1790s, leaders of the French Revolution systematically repressed religion in an attempt to replace God, the Son, and the Holy Ghost with a new trinity of Liberty, Equality, and Fraternity (Durant, 1975, vol. 11, p. 43). Approximately 25,000 priests, who refused to swear allegiance to the new regime after it confiscated the church's property, fled to other lands. In the ensuing Reign of Terror, priests were among the many thousands of Frenchmen who were guillotined. Six carriage-loads of priests were executed on a single day in 1792 (Durant, 1975, vol. 11, p. 44). Anti-religious violence, conducted specifically in an attempt to eradicate religion, continued even into the twentieth century. For example, Stalin's regime, in addition to directly or indirectly killing millions of Russian citizens, also methodically closed or destroyed thousands of Greek Orthodox churches and killed hundreds of priests. Fifty-five priests were executed on a single day in 1938 (Brown, 2006). In short, while Camp A writers are correct in noting religious wars in history, when placed in a larger historical context, clearly these claims are significantly inflated to help make the Camp A authors' points.

Scholars analyzing the Camp A literature are also concerned at the attempts by these writers to "prove" that God cannot exist by means of scientific or philosophical arguments (Haught, 2008; Ward, 2008). Camp A criticisms of the



*The Albert Einstein Memorial*, 1979. Robert Berks, 1922-2011. Bronze statue located on the grounds of the National Academy of Sciences in Washington, DC.

traditional philosophical arguments for God, such as those of the medieval scholar Thomas Aquinas, are hardly new. Difficulties with these arguments have been known for decades, if not centuries. Camp A "scientific" arguments against God are fundamentally flawed, since science, properly defined, cannot say anything one way or the other about the existence or nature of a supreme being.

Along this line, perhaps the most succinct definition of science is given by the

National Academy of Science (NAS), the premier scientific society in the U.S.A. (NAS, 2008, p. 10): “The use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process.” The statement elaborates, “If explanations are based on purported forces that are outside of nature, scientists have no way of either confirming or disproving those explanations.” Many other writers have expressed similar views (Pennock, 1999, p. 5). Thus, the “scientific” arguments against religion raised by Camp A writers do not have much credibility.

A similar assessment applies to the assumption, which very frequently appears in Camp A literature, that the empirical world studied by modern science comprises all of truth and reality. This view is known variously as scientific materialism, or scientism. It may be easy to dismiss religion from this worldview, but it is just as easy to dismiss art, literature, music, philosophy, ethics, and many other disciplines widely considered to be essential to understanding the human condition. What’s more, the scientific materialist worldview itself would itself have to be questioned, since it cannot be derived from experimental science or mathematical reasoning and thus must be accepted on faith (Haught, 2008, p. 45).

One important point is that the writings of the Camp A authors on the topic of religion are not often published in respected, peer-reviewed journals. This material may be typical of polemical literature targeted directly to the public, but it is not solid, peer-reviewed scholarship, nor is it based on solid, peer-reviewed scholarship. This fact may be taken for granted in the academic community, but it is not well known among lay members of the public, many of whom mistakenly believe that Camp A writings represent authoritative statements of leading scholars in the field, based on solid research. If any of the Camp A writers believe they have arguments or insights worthy of peer-reviewed publication, they are invited to submit them to a journal in the field of theology, philosophy, religious studies, or history, as appropriate. Until they do so, it is hard for professional scholars to take this material very seriously.



*Richard Dawkins, 2013. Albert H. Teich, 1942-*

Published reviews of the Camp A works are generally rather negative. Here are a few excerpts from reviews by some prominent scientists and secular scholars:

Despite my admiration for much of Dawkins’s work, I’m afraid that I’m among those scientists who must part company with him here. Indeed, *The*



*God Delusion* seems to me badly flawed. ... (H)is book makes a far from convincing case. (Orr, 2007)

(T)he new atheists believe that they alone are in possession of truth; like Christian fundamentalists, they read scripture in an entirely literal manner and seem never to have heard of the long tradition of allegoric or Talmudic interpretation. (Armstrong, 2009, pp. 303-305)

The new atheists are saying in effect that if God exists at all, we should allow this God's identity to be determined once and for all by the fundamentalists of the Abrahamic religious traditions. (Haught, 2008, pp. xv-xvi)

I am afraid that *The God Delusion* is a deeply flawed book that does not approach Dawkins' usual standards, and suspect that he got carried away by the sheer enjoyment of writing it. (E. B. Davies, 2010)

### **The War Between Science and Religion: Camp B**

Camp B is led by certain religious fundamentalists, mostly, although not exclusively, of the conservative Protestant tradition. Their criticisms of science are, in most cases, deeply rooted in biblical inerrancy, which is the view that the Bible is an *infallible* and *complete* repository of God's word and that it must be read as a scientific and historical treatise as well as a religious text. In this regard, they insist that Genesis should be read very literally as the creation of the Earth (or the entire universe), *in toto* and *ex nihilo*, over a six-day period six thousand years ago.

Before continuing, it is important to note that this view of Bible inerrancy and completeness goes well beyond the LDS view of the Bible. The central lesson that Joseph Smith learned as a young man, after hearing numerous contending preachers, was that many of the issues he was concerned about could not be resolved solely by literal readings of biblical scripture—additional revelation was needed. In a similar vein, the Book of Mormon, which was published a few years after his first vision, noted that many “plain and precious things” had been deleted through the years from the biblical text (1 Nephi 13:28-40). He also rejected *ex nihilo* creation, at least in the sectarian sense.

Similarly, Brigham Young declared,

As for the Bible account of the creation we may say that the Lord gave it to Moses, or rather Moses obtained the history and traditions of the fathers, and from these picked out what he considered necessary, and that account has been handed down from age to age, and we have got it, no matter whether it is correct or not, and whether the Lord found the earth empty and void, whether he made it out of nothing or out of the rude elements; or whether he made it in six days or in as many millions of years, is and will remain a matter of speculation in the minds of men unless he give revelation on the subject (JD, vol. 14, p. 116 [14 May 1871]).

Certainly there are some LDS leaders who have expressed a preference for relatively literal interpretations of scripture. For example, Elder Bruce R. McConkie

taught at one time that the six days of creation were six days according to Kolob, or in other words, six thousand years (McConkie, 1966, pp. 130, 184), though he later accepted the view of a very old earth (see Lewis, this volume). President Joseph Fielding Smith rejected evolution and in general argued for a relatively strict interpretation of biblical scripture. Yet even he nonetheless acknowledged that limits must be placed on highly literal readings of biblical scripture:

Even the most devout and sincere believers in the Bible realize that it is, like most any other book, filled with metaphor, simile, allegory, and parable, which no intelligent person could be compelled to accept in a literal sense.

... The Lord has not taken from those who believe in his word the power of reason. He expects every man who takes his “yoke” upon him to have common sense enough to accept a figure of speech in its proper setting, and to understand that the holy scriptures are replete with allegorical stories, faith-building parables, and artistic speech. ... Where is there a writing intended to be taken in all its parts literally? Such a writing would be insipid and hence lack natural appeal. To expect a believer in the Bible to strike an attitude of this kind and believe all that is written to be a literal rendition is a stupid thought. No person with the natural use of his faculties looks upon the Bible in such a light (Smith, 1956, vol. 3, p. 188).



Returning to the analysis of Camp B literature, many of these writers are not content to simply criticize Camp A writers for their lack of religious faith, to argue for a strict compliance with biblical scripture, or even to express general unease with the increasing dominance of science in modern society. Instead, they argue that major portions of modern science are *technically* in error (Foster, 1991; Morris, 1985; Whitcomb, 1961). Some say that they have evidence that the Earth really is a mere six thousand years old, that evolution never really happened, or that big bang cosmology is wrong. Others acknowledge the general fact that the Earth and universe appear very old but suggest that God created the world to appear that way, perhaps as a test of faith. In a larger sense, these writers devote considerable efforts to identifying phenomena that cannot be explained by science, thinking that such instances prove the hand of God.

Finally, just like Camp A writers, Camp B writers are firmly convinced that their opponents (science in general, and evolution in particular) are responsible for many of the ills of modern society. Morris (1997), in a single breathtaking sentence, blamed science for “racism, fascism, Marxism, imperialism, ... Freudianism, promiscuity, abortion, homosexuality (and) drug use.” (Did he leave anything out?)

And Camp B writers, also like their Camp A counterparts, often insist that this is an all-or-nothing matter, criticizing those writers who attempt to find a moderate middle ground. As one writer emphasized, “This is an all or nothing proposition — there is no middle ground to stand on” (Truck, 2010).

Needless to say, Camp B literature has its critics. From a scholarly point of view, Camp B literature, like Camp A literature, it is often blustery in tone. Like Camp A writers, these writers typically do not present any new data or scholarship, but mostly pick faults in their opponents. Like Camp A writers, Camp B writers often quote a handful of outspoken writers from the opposing camp, then assume that all think that same way. And like Camp A writers, Camp B writers typically do not publish their work in respected, peer-reviewed journals. Instead their books and articles are, for the most part, targeted directly to the lay public.

With regard to technical arguments raised by Camp B writers, the consensus of scientists, even among scientists who are religious believers (and even among LDS scientists), is that these arguments are deeply flawed and do not pose a significant technical challenge to existing scientific theories (Collins, 2006; Fairbanks, 2007; Miller, 1999; Miller, 2008; Stephens, 2001; see also Bailey, 2013c).

To begin with, Camp B claims that the Earth and the universe are only six thousand years old fly in the face of modern radiometric dating, which has been refined and improved over several decades and which produces very consistent and reliable dates (typically many millions of years) for the various epochs of the Earth’s development (Dalrymple, 2004). There is no possibility that each and every one of many thousands of careful measurements is off by factors of millions. A few decades ago one might have been able to claim “reasonable doubt” with regard to radiometric dating measurements, but not today.

Camp B claims that “scientists can’t explain” this or that phenomenon are often out of date. For example, Camp B writers have asserted that scientists have not found any transitional fossils documenting the hypothesized transition between modern land-based mammals and sea-based mammals such as orcas and dolphins (Gish, 1985, pp. 78-79). Yet at least thirty distinct intermediate species are now known (Thewissen, 2002; Zimmer, 2001, p. 138; see also Bailey, 2013b). Similarly, Camp B writers are fond of arguments based on probability and information theory (Dembski, 1998; Foster, 1991, pp. 79-83). But mathematicians who have examined these arguments find them deeply flawed (Elsberry, 2011; see also Bailey, 2000).

It should be emphasized that there may be inaccuracies in the existing theories of geology, biology, and cosmology. Every year, tens of thousands of peer-reviewed studies are published in these fields, as scientists re-examine and refine these theories. But the overall picture of biological organisms descending from common ancestors over many millions of years is, according to the vast majority of scientists, hardly in doubt. Indeed, it is hard to interpret recent DNA data in any other reasonable way. As a single example, humans, gorillas, bonobos, and a handful of other primate species

share a common genetic defect: unlike almost all other animals, we cannot produce our own vitamin C, due to a mutated gene. A detailed analysis of mutations within this gene provides a virtual blow-by-blow story of how these species diverged from common biological ancestors (Fairbanks, 2007, pp. 53-55; see also Bailey, 2013e).

Just as importantly, there are significant philosophical and theological difficulties with Camp B literature. To begin with, the Camp B search for phenomena that cannot be explained by natural laws, in an attempt to “prove” the hand of God, is almost a contradiction in terms, since science, as explained above, cannot comment one way or the other on the existence or nature of a supreme being. Also, attempting to “prove” the hand of God using scientific analysis indirectly implies that faith is not an essential feature of religion and ironically affirms the scientific materialist worldview of Camp A writers. Finally, defining religion in terms of what is currently unexplained in science is tantamount to “God of the gaps” theology, which has left a legacy of disappointment as science continues to advance.

The last straw for many observers is the notion, which has been seriously advanced by some Camp B writers, that the world may appear to be very old, governed by natural laws and the product of an evolutionary development, but this is only because God created the world with an “appearance of age,” perhaps as a test of faith (Whitcomb, 1961, pp. 233-238; Morris, 1985, p. 203). While this notion may give comfort to some, most others find it highly problematic, tantamount to “God the Great Deceiver” theology.

Consider, for example, some implications of this “appearance of age” theory: (a) each of the roughly  $10^{30}$  specks of rock 0.1 mm in size within two miles of the Earth’s surface must have had its isotopic profile deliberately altered, so that when twenty-first century scientists analyze it, it would appear millions of years old, when in reality it is only a few thousand years old; (b) fossils must not be from real ancient creatures millions of years ago but were planted in rock layers to appear very old; (c) each of the  $10^{23}$  photons of light from galaxies millions of light-years away (which photons were thus emitted millions of years ago) reaching the Earth *every second* must have been individually constructed, in transit to the Earth a few thousand years ago, with spectral characteristics of light emitted from distant galaxies; (d) supernova explosions in distant galaxies must not have really occurred – instead, a few thousand years ago, God created a stream of incoming photons so that when twenty-first century astronomers would view them, it would look like a supernova exploded. Surely there is a better approach to reconciling religion with modern science! (Bailey, 2013d).

In general, the same challenge could be offered to Camp B writers as to Camp A writers: If any of these writers believe they have sound arguments drawing some prevailing scientific theory into question, which arguments they believe are truly worthy of serious consideration, they are invited to submit this material to a leading journal in the field. Until these writers do this, it is hard for professional research scientists to take them very seriously.



Although scientists have long rejected Camp B literature, it is also important to note that many prominent religious writers also question these writings. Here are just a handful of excerpts that could be cited, including two from LDS authorities (Brigham H. Roberts and James E. Talmage), one from Pope John Paul II, and one from Francis Collins, the Director of the National Institutes of Health and an evangelical Christian:

On the other hand, to limit and insist upon the whole of life and death to this side of Adam's advent to the earth, some six or eight thousand years ago, as proposed by some, is to fly in the face of the facts so indisputably brought to light by the researcher of science in modern times (Roberts, 1931, pp. 363-364).

The opening chapters of Genesis, and scriptures related thereto, were never intended as a textbook of geology, archaeology, earth-science or man-science. ... We do not show reverence for the scriptures when we misapply them through faulty interpretation (Talmage, 1931, p. 244).

The Bible itself speaks to us of the origin of the universe and its make-up, not in order to provide us with a scientific treatise, but in order to state the correct relationships of man with God and with the universe (Pope, 1986).

The image of God as a cosmic trickster seems to be the ultimate admission of defeat for the (Camp B) perspective. Would God as the great deceiver be an entity one would want to worship? Is this consistent with everything else we know about God from the Bible, ... namely, that he is loving, logical and consistent? (Collins, 2006, p. 177).

Other LDS commentaries on science will be presented below.

### **Would Camp A or Camp B Literature Pass Peer Review Standards?**

As mentioned above, neither Camp A nor Camp B writers typically publish their works in respected, peer-reviewed journals in the respective fields (theology, philosophy, or religious studies on one hand, or geology, biology, and physics on the other). But it is worth asking whether these writings, if submitted, would have much chance at being accepted.

While peer-review standards vary from journal to journal and field to field, some commonly accepted criteria include the following:

1. Relevance to the journal's charter.
2. Clarity of exposition.
3. Objectivity.
4. Acknowledgment of prior work: authors must demonstrate familiarity with existing literature in the field; sweeping dismissals of other works are not acceptable.
5. Freedom from plagiarism: this is invariably considered a serious breach of ethics.
6. Theoretical background: what exactly is the hypothesis being analyzed?
7. Experimental procedures and statistical methods.

8. Sound conclusions: have the authors adequately justified their claimed results?
9. Originality: even if all the above are satisfactory, is it worth publication?

It is clear, from our discussion above, that neither Camp A nor Camp B literature would pass peer review. The bluster and polemic language that is often seen in both camps would be grounds for immediate rejection. Not acknowledging prior scholarship in the field, which unfortunately is typical of both Camp A writers (e.g., ignoring a large body of literature in theology and the history of religion) and Camp B writers (e.g., ignoring a large body of published scientific results), would again be fatal. The requirement for sound, carefully reasoned arguments, verified by well-qualified reviewers, would doom writings from both camps, as we have seen above. And originality is also an issue, as writers from both camps seldom present fundamentally new insights or results.

In general, we have to ask whether Camp A or Camp B writers are truly qualified to present the sweeping critiques of the opposing camp that they present to the public. According to an ancient account, when Pharaoh Ptolemy I of Egypt grew frustrated at the degree of effort required to master geometry, he asked Euclid if there were some easier path. Euclid is said to have replied: “There is no royal road to geometry” (Durant, 1975, vol. 2, p. 501). Indeed, and there is no “royal road” to science or religion, either. Flawed, polemic arguments do not advance a cause no matter how strongly its adherents believe in it. As the Apostle Paul wrote, “For if the trumpet give an uncertain sound, who shall prepare himself to the battle?” (1 Corinthians 14:8).

### **Can This Marriage Be Saved?**

We have explained why neither Camp A nor Camp B literature offers much help to those seeking a reasonable, intellectually honest harmony between science and religion. So what can be said in a positive light?

First of all, it is essential to acknowledge that while Latter-day Saints, along with many other seekers of truth, believe that all truth ultimately may be attained, in the meantime both scientists and religious believers need to recognize the limitations of their own domain and respect the other domain. As we noted above, there may be inaccuracies in the existing theories of geology, biology, and cosmology. Every year, tens of thousands of peer-reviewed studies are published in these fields, as scientists re-examine and refine these theories. But the overall picture of biological organisms descending from common ancestors over many millions of years is, according to the vast majority of scientists, hardly in doubt.

Along this line, it is instructive to make an inventory of biblical passages that have some relevance to modern science. There are a few references to astronomy, including, interestingly enough, some mentions of specific stars and constellations. For example, Job 38:31-33 declares, “Canst thou bind the sweet influences of Pleiades, or loose the bands of Orion? Canst thou bring forth Mazzaroth [meaning unknown]



in his season? Or canst thou guide Arcturus [*Ursa major*] with his son's [cubs]? Knowest thou the ordinances of heaven? Canst thou set the dominion thereof in the earth?"

There are, as one might expect, a few references to the ancient cosmology. 1 Samuel 2:8 declares, "for the pillars of the earth (are) the LORD's, and he hath set the world upon them." In 1 Chronicles 16:30, we read, "the world also shall be stable, that it be not moved," and similarly Psalm 93:1 states, "the world also is stablished, that it cannot be moved." Psalm 104:5 describes God as the being "(Who) laid the foundations of the earth, (that) it should not be removed for ever." Ecclesiastes 1:5 states, "The sun also ariseth, and the sun goeth down, and hasteth to his place where he arose." Many have ridiculed the Bible for such passages, but a more honest reading of these passages in context makes clear that in every case they were in a poetic context, praising God for the wonders of creation, and were not intended to be read as technically precise declarations in the modern scientific sense.

There are only a handful of biblical passages that present quantitative data at all. Among them are the passages in the Old Testament giving dimensions of various structures in Solomon's temple. But again, it is clear from context that these figures were intended only to give the reader a notion of the scale of the structure, not as highly precise scientific measurements in our modern sense. For example, 1 Kings 7:23 and 2 Chronicles 4:2 both say that the circular baptismal font on the temple grounds was 10 cubits in diameter and 30 cubits in circumference. Obviously this cannot be precisely correct, because the ratio of the circumference of a circle to its diameter is  $\pi = 3.14159$ . ... But surely these measurements were given as

approximations, to enable one to judge the scope of the temple features and were not intended as precise mathematical fact.

In short, one can search in vain for a single passage of biblical scripture written in the precise, quantitative, testable style of a modern scientific research work. So those who read the Bible as a scientific textbook are surely mistaken, as LDS Apostle James E. Talmage has noted above (Talmage, 1931, p. 244).

According to the Gospel of Matthew, when Jesus was asked if Jews should pay taxes to Rome, he replied: “Render therefore unto Caesar the things which are Caesar’s; and unto God the things that are God’s” (Matthew 22:21). Similar advice could be offered here: “Render unto science the things which are scientific and unto religion the things that are religious.”

### **What Do Science and Religion Have in Common?**

Many a marriage counselor, when meeting with a couple having difficulty, has advised them to make a list of what they have in common – experiences, interests, aspirations, and life goals. Often after examining these lists, the couple recognizes they really do have a lot in common, and their commonalities exceed whatever differences they may perceive. Similarly, it is useful to note that science and religion (the LDS religion in particular) actually have much in common.

To begin with, the Judeo-Christian religion since the beginning has included as a fundamental tenet a quest for truth and enlightenment. Just a few of the biblical verses with this philosophy include, “[Y]e shall seek me, and find *me*, when ye shall search for me with all your heart.” (Jeremiah 29:13); “Seek and ye shall find (Matthew 7:7) and “(Y)e shall know the truth, and the truth shall make you free.” (John 8:32). Even more pointed admonitions are included in LDS scriptures. In the Book of Mormon we read scathing criticisms of those who say, “We have received, and we need no more!” (2 Nephi 28:27). The Doctrine and Covenants includes the memorable passage, “The glory of God is intelligence, or, in other words, light and truth” (D&C 93:36). So the quest for truth is certainly one arena where scientists and religious believers are on common ground.

Along this line, it is often said that religion teaches unquestioning faith. But this is not what is taught in scriptures. For example, the Apostle Paul admonished, “Prove all things; hold fast that which is good.” (1 Thessalonians 5:21).

Another area of commonality, particularly strong in the context of LDS theology, is the “idea of progress.” Conservative scholar Robert Nisbet defined the “idea of progress” as the notion that “mankind has advanced in the past, is now advancing, and may be expected to continue advancing in the future” (Nisbet, 1980, pp. 4-5). Note that this is almost a word-for-word restatement of the LDS Ninth Article of Faith, encapsulating the LDS doctrine of eternal progression.



*Vision of St. Thomas Aquinas, ca. 1720s*  
Martino Altomonte, 1657-1745

Most other ancient religions believed in an endless course of recurrent cycles, similar to the day, month, and year of the calendar and the birth-youth-maturation-die cycle of ordinary life. In Babylonian cosmology, a Great Year was thought to be 424,000 years, after which the universe repeats (Eliade, 1971, p. 115). Even Plato's cosmology was cyclic, with a periodic destruction and recreation of the world (Plato, 1952, p. 451).

The Hebrew religion, in contrast, taught what is now termed "linear," or "progressive" history: the world had a starting point in the past, and we can look forward to a future epoch when the misfortunes, injustices, and evil of this world will be set right. This can be seen in the Genesis account of the creation of the earth; in the

promise to Abraham that his seed would prosper; in the account of Moses and the children of Israel migrating from Egypt to the promised land; and finally, in their anticipation of the Messiah who would reign in glory. Christianity further developed this tradition of progressive history by identifying Christ as the Messiah, by naming his advent as the "meridian of time," by teaching a higher law that superseded the Law of Moses, by predicting a future second coming of Christ, and by describing a heaven where the righteous dead will be resurrected (Eliade, 1971, pp. 102-130, 141-147). Later Christian theologians such as St. Augustine correctly observed that this philosophy rules out the notion of eternal recurrence (Augustine, 1952, p. 350).

Closely connected with this concept of linear, progressive history is the Judeo-Christian belief that God governs the world based on a system of rational laws. The biblical account of the creation, for example, can be read as the creation of order out of chaos. Faith in the rationality of God is also emphasized in books such as Job, which eloquently teaches that ultimately everything will be righted in spite of the many tragedies and hardships in life (Haught, 1995, pp. 22-25).

British philosopher Alfred North Whitehead noted that modern science, as it developed in the West, was based on this faith in rationality:

Faith in reason is the trust that the ultimate natures of things lie together in a harmony which excludes mere arbitrariness. It is the faith that at the base of things we shall not find mere arbitrary mystery. The faith in the order of nature which made possible the growth of science is a particular example of a deeper faith (Whitehead, 1967, pp. 17-19, 27).

British-American physicist Paul Davies wonders whether modern science would ever have evolved in the absence of Judeo-Christian monotheism:

Without belief in a single omnipotent rational lawgiver, it is unlikely that anyone would have assumed that nature is intelligible in a systematic quantitative way, mirrored by eternal mathematical forms. ... Without minds prepared by the cultural antecedents of Greek philosophy and monotheism (or something similar) — and in particular the abstract notion of a system of hidden mathematical laws — science as we know it may never have emerged (P. Davies, 2010, pp. 74-75).

In the early twentieth century, French theologian Pierre Teilhard de Chardin argued that human progress was inexorable, virtually mandated by the natural laws of the universe. He further saw the idea of progress as the one theme that could re-unify science and religion: “To incorporate the progress of the world in our picture of the kingdom of God ... would immediately and radically put an end to the internal conflict from which we are suffering” (Teilhard, 1975, p. 96).

Similarly, scholar Robert Wright describes a vector of progress, consisting of ever-widening extensions of human cooperation, extending over several millennia:

(I)f ... we talk about the objectively observable features of social reality, the direction of history is unmistakable. When you look beneath the roiled surface of human events, beyond the comings and goings of particular regimes, beyond the lives and deaths of the “great men” who have strutted on the stage of history, you see an arrow beginning tens of thousands of years ago and continuing to the present. And, looking ahead, you see where it is pointing. ... Maybe history is ... not so much the product of divinity as the realization of divinity (Wright, 2001, pp. 17, 332).

One other very important area of commonality is reverence for the magnificence of the universe and the elegant laws that govern it, laws that grateful humans have been privileged to comprehend. As mentioned in the introduction, a surprisingly high percentage of the public (even more so among agnostics), acknowledge a deep reverence for the universe on at least a weekly basis. Albert Einstein understood this principle well, even though he personally had difficulties with traditional notions of God. He once wrote:

On the other hand, I maintain that the cosmic religious feeling is the strongest and noblest motive for scientific research. ... Those whose acquaintance with scientific research is derived chiefly from its practical results easily develop a completely false notion of the mentality of the men who, surrounded by a skeptical world, have shown the way to kindred spirits scattered wide through the world and through the centuries. Only one who has devoted his life to

similar ends can have a vivid realization of what has inspired these men and given them the strength to remain true to their purpose in spite of countless failures. It is cosmic religious feeling that gives a man such strength (Einstein, 1930, p. 39).

The astronomer Carl Sagan expressed this same idea in the following terms:

How is it that hardly any major religion has looked at science and concluded, "This is better than we thought! The Universe is much bigger than our prophets said, grander, more subtle, more elegant?" Instead they say, "No, no, no! My god is a little god, and I want him to stay that way." A religion old or new that stressed the magnificence of the universe as revealed by modern science might be able to draw forth reserves of reverence and awe hardly tapped by the conventional faiths. Sooner or later, such a religion will emerge (Sagan, 1994, p. 52).

### **The LDS Perspective on Modern Science**

While many of these issues are common to a broad range of Judeo-Christian thought, there are some interesting perspectives specifically from an LDS point of view. Arguably the most important of these is the traditional LDS notion that God operates in accord with, not in violation of, natural law (although we might not fully understand all of these laws at the present time). Sadly, this tenet is not widely appreciated in the LDS community. Here are a few excerpts from the discourses of LDS leaders where this view is clearly expressed:

Yet I will say with regard to miracles, there is no such thing save to the ignorant — that is, there never was a result wrought out by God or by any of His creatures without there being a cause for it. There may be results, the causes of which we do not see or understand, and what we call miracles are no more than this — they are the results or effects of causes hidden from our understandings (Brigham Young, JD, vol. 13, pp. 140-141 [11 Jul 1869]).

Among the popular errors of modern times, an opinion prevails that miracles are events which transpire contrary to the laws of nature, that they are effects without a cause. If such is the fact, then, there never has been a miracle, and there never will be one. The laws of nature are the laws of truth. Truth is unchangeable, and independent in its own sphere. A law of nature never has been broken. And it is an absolute impossibility that such law ever should be broken (Parley P. Pratt, 1855, p. 100).

Miracles are commonly regarded as occurrences in opposition to the laws of nature. Such a conception is plainly erroneous, for the laws of nature are inviolable. However, as human understanding of these laws is at best but imperfect, events strictly in accordance with natural law may appear contrary thereto. The entire constitution of nature is founded on system and order (James E. Talmage, 1899, p. 20).

Miracles cannot be in contravention of natural law, but are wrought through the operation of laws not universally or commonly recognized (James E. Talmage, 1915, p. 139).





*Christus Consolator*, 1838. Albert Bertel Thorvaldsen, 1770-1844  
 Replica located in the North Visitors Center of Temple Square, Salt Lake City, Utah

Latter-day Saints are inclined to hold that forces about us, known in part through common human experience, especially in the field of physical science, were employed in the formation of the earth (John A. Widtsoe, 1960, p. 150)

Given that we should view God as working within the realm of natural law, and there are no “miracles” that fundamentally contravene natural law, then why does there need to be a “war” between science and religion? Indeed, the LDS notion of natural law completely removes any need for conflict between the two disciplines.

Even beyond the LDS teachings on the topic of natural law, a survey of LDS discourse on modern science yields numerous very positive assessments, such as the following:

True science is a discovery of the secret, immutable and eternal laws, by which the universe is governed (H. Tate to J. Taylor, *Times and Seasons*, vol. 4, p. 46 [15 Dec 1842]).

Every discovery in science and art, that is really true and useful to mankind, has been given by direct revelation from God, though but few acknowledge it (Brigham Young, JD, vol. 9, p. 369 [31 Aug 1862]).

[O]ur religion will not clash with or contradict the facts of science in any particular. ... If we understood the process of creation there would be no mystery about it, it would be all reasonable and plain, for there is no mystery except to the ignorant (Brigham Young, JD, vol. 14, p. 116 [14 May 1871]).



Truth is truth forever. Scientific truth cannot be theological lie. To the sane mind, theology and philosophy must harmonize. They have the common ground of truth on which to meet (John A. Widtsoe, 1908, p. 156).

Religion and science have sometimes been in apparent conflict. Yet the conflict should only be apparent, not real for science should seek truth, and true religion is truth. ... The gospel accepts and embraces all truth; science is slowly expanding her arms and reaching into the invisible domain in search of truth. The two are meeting. ... Time is on the side of truth — for truth is eternal (Ezra Taft Benson, 1966, p. 546).

But in a larger sense [the 20th century] has been the best of all centuries. ... The life expectancy of man has been extended by more than twenty-five years. Think of it. It is a miracle. The fruits of science have been manifest everywhere. ... This has been an age of enlightenment. The miracles of modern medicine, of travel, of communication are almost beyond belief (Gordon B. Hinckley, 1999).

President Hinckley's comments are particularly interesting in light of the pervasive talk that is often heard of the inexorable decline of society. He acknowledges that such talk can be self-defeating; to the contrary, there is much to celebrate, and the progress due to science and technology is certainly among the proudest achievements of our society.

The above comments are certainly not exhaustive, and there are certainly instances of LDS leaders voicing critical comments towards certain aspects of modern science (e.g., evolution). Such comments are often highlighted by critics of the LDS movement who attempt to portray the LDS movement as anti-scientific. But a larger study of LDS discourse reveals such comments to be in the minority, easily outnumbered by much more positive commentary.

It is worth pointing out that Brigham Young University has strong departments in numerous arenas of modern science, certainly including astronomy, botany, zoology, geology, physics, chemistry, computer science, and mathematics. Evolution in particular has been taught at the university for decades with full approval from the LDS leadership, and several of the BYU faculty have made notable contributions to this field.

With regard to the Church's "official" position on the age of the Earth, a good source is the *Encyclopedia of Mormonism's* article "Age of the Earth," which starts with the noncommittal statement, "The scriptures do not say how old the earth is, and the Church has taken no official stand on this question. ... Nor does the Church consider it to be a central issue for salvation" (Petersen, 1992).

The Church's view on evolution has "evolved" somewhat over time. In 1909, the First Presidency released a statement entitled "The Origin of Man," which included a comment skeptical of the notion that "the original human being was a development from lower orders of the animal creation." However, in 1925 the First Presidency

released another statement, largely a condensation of the 1909 statement, which omitted this language.

In 1930, Elders Joseph Fielding Smith, Brigham H. Roberts, and James E. Talmage became engaged in a discussion over whether there were “pre-Adamites” or other living organisms before Adam. After several manuscripts were circulated, the First Presidency concluded that additional discussion would be fruitless and released a letter to all general authorities. It noted that the statement that pre-Adamites existed was “not a doctrine of the Church” and similarly for the opposite assertion. It concluded with the instruction:

Upon the fundamental doctrines of the Church we are all agreed. Our mission is to bear the message of the restored gospel to the world. Leave geology, biology, archaeology, and anthropology, no one of which has to do with the salvation of the souls of mankind, to scientific research, while we magnify our calling in the realm of the Church (Evenson, 1992).

In 1992, this passage was included as part of a brief article on “Evolution” in the *Encyclopedia of Mormonism*, which article was prepared with direct input from President Gordon B. Hinckley. Subsequently this article, together with the 1909 and 1925 statements and one other document were assembled to form what is now known as the BYU Packet on “Evolution and the Origin of Man,” approved by BYU Board of Trustees and LDS First Presidency (BYU, 1992). As far as the present author is aware, this packet, including the *Encyclopedia* article, is the latest word.

We should add that this noncommittal approach is a wise one because just as it is important for science to stay scientific, focused on studying natural laws, processes, and empirical data, so it is important for religious movements to stay focused on religion and not embrace in their central belief systems some particular scientific theory or worldview. As Holmes Rolston observed, “The religion that is married to science today will be a widow tomorrow. ... Religion that has too thoroughly accommodated to any science will soon be obsolete” (Rolston, 2006, p. ix).

### Conclusion

We have presented here a high-level survey of issues relevant to the perceived conflict between modern science and religion. Certainly there are numerous specific questions and issues that have not been treated. What’s more, this study only briefly discusses how these specific issues connect to LDS scriptures and discourse. But it is hoped that it presents at least a framework within which such a dialogue can begin.

The overall consensus of respected writers from both the science and religious worlds, including several LDS writers, is that it is not only futile for religion and science to battle each other; it is also unnecessary. Most major religious denominations, including the LDS Church, have either made peace with the scientific world or at least have recognized that it is pointless to attack the world of science. Most leading

scientists either affirm a religious faith in some general sense or at least recognize that it is pointless to attack the world of religion.

And both scientists and religious believers can stand in awe at the majesty of the universe, which is now known to be much vaster, more intricate and more magnificent than ever before realized in human history. So why all the fighting?

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### Endnotes

1. Beginning in the second edition, Darwin modified the wording of his conclusion to read as follows (emphasis added):

There is grandeur in this view of life, with its several powers, having been originally breathed *by the Creator* into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.





# TWENTY QUESTIONS ABOUT SCIENCE AND RELIGION

David H. Bailey

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### Introduction

Today there is a widespread perception of a “war” between science and religion. On one hand, writers of secular and scientific backgrounds, notably a group known as the “New Atheists,” have recently become significantly more outspoken. They criticize religion as fundamentally irrational and harmful and blame religion for much of what ails the world today. On the other hand, writers of certain religious backgrounds (mostly not LDS) perceive the rise of modern science as a mortal threat to their fundamental religious beliefs. They emphasize flaws and gaps in scientific theories and promote their material to local and state school boards.

Yet both science and religion have much to gain from respectful interaction. Both are part of a fundamental quest for truth, as exemplified by the scripture, “Seek and ye shall find.”<sup>1</sup> Both espouse the “idea of progress,” which Robert Nisbet defined as the notion that “mankind has advanced in the past, is now advancing, and may be expected to continue advancing in the future”<sup>2</sup> (note the similarity to the LDS Ninth Article of Faith). Finally, both scientists and religious believers can stand in awe at the majesty of the universe, which is now known to be much vaster, more intricate, and more magnificent than ever realized in human history (Bailey, 2014).

Nonetheless, while science and religion have much in common, there are still many specific issues that must be addressed. To that end, this paper attempts to address briefly some of the questions that arise. This analysis is presented in an LDS context, although most of these issues and discussion apply to a general Judeo-Christian audience. As always, these comments are the author’s own; others may have different perspectives.



Portrait of Luca Pacioli (ca. 1445 - ca. 1514), 1495  
 Jacopo de' Barbari, ca. 1440/50 - ca. 1515

### 1. Does modern science refute religion? Does science have all the answers?

As mentioned above, one of the central assertions of the New Atheists and other critics of religion is that modern science refutes religion. They often argue that all precepts, including the existence of God, must be tested scientifically and rejected if not confirmed. But this view, known variously as “scientific materialism” or “scientism,” has long been rejected by philosophers of religion: God is not a scientific hypothesis.

Part of the difficulty here is to define properly what science is. Perhaps the most succinct definition is given by the National Academy of Science:<sup>3</sup> *The use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process.* The Academy elaborates as follows:

In science, explanations must be based on naturally occurring phenomena. Natural causes are, in principle, reproducible and therefore can be checked independently by others. If explanations are based on purported forces that are outside of nature, scientists have no way of either confirming or disproving those explanations.

Thus it is clear that science, properly defined, cannot possibly conflict with religion, since science can say nothing one way or the other about the existence

or nature of a supreme being. It is also worth pointing out that scientism is itself a belief system that is not testable by the methods of empirical science. If one rejects religion because it is not empirically testable, then one would also have to reject scientism as well. There is no free lunch.

## 2. Does modern science repudiate miracles?

It is widely believed that modern science stands at odds with miracles as recorded, say, in the Bible. This stems from the traditional notion, taught for decades if not centuries, that miracles are contraventions of natural law. Eighteenth century philosopher David Hume, for example, defined a miracle as “a transgression of a law of nature.”<sup>4</sup> Contemporary creationist Kevin Anderson declared that “a miracle is an event not explainable to natural processes.”<sup>5</sup> If one presumes this view, then indeed miracles lie utterly outside the world of scientific laws.

But in the LDS tradition, this basic premise is rejected. Parley P. Pratt declared:

Among the popular errors of modern times, an opinion prevails that miracles are events which transpire contrary to the laws of nature, that they are effects without a cause. If such is the fact, then, there never has been a miracle, and there never will be one. The laws of nature are the laws of truth. Truth is unchangeable, and independent in its own sphere. A law of nature never has been broken. And it is an absolute impossibility that such law ever should be broken.<sup>6</sup>



*Crossing the Red Sea*

Brigham Young was even more explicit:

Yet I will say with regard to miracles, there is no such thing save to the ignorant — that is, there never was a result wrought out by God or by any of His creatures without there being a cause for it. There may be results, the causes of which we do not see or understand, and what we call miracles are no more than this — they are the results or effects of causes hidden from our understandings.<sup>7</sup>

James E. Talmage added the following:

Miracles are commonly regarded as occurrences in opposition to the laws of nature. Such a conception is plainly erroneous, for the laws of nature are inviolable. However, as human understanding of these laws is at best but imperfect, events strictly in accordance with natural law may appear contrary thereto. The entire constitution of nature is founded on system and order.<sup>8</sup>

It is true that many of the miracles recorded in the Bible may have more prosaic explanations. For example, two scientists recently concluded, based on computer simulations, that a “wind setdown” effect may have been the cause of the drying up of the sea where the Israelites crossed.<sup>9</sup> Also, modern medicine can now treat conditions that required miraculous cures in the Bible, such as healing diseases like leprosy (by antibiotics), and restoring vision to certain blind persons (by corrective lenses and/or surgery). But in any event, miracles need not be transgressions of natural law.

### **3. How old is the Earth? How old are the geologic ages?**

One challenge in assessing the age of the Earth is the fact that virtually all rocks that were originally on the face of the earth when it first formed have subsequently been subducted into the Earth’s mantle. The oldest mineral ever found on earth, a zircon specimen found in the Jack Hills region of Western Australia, has been measured to be 4.4 billion years old, so the Earth is at least this old.<sup>10</sup> Scientists have noted that many meteorites, which were formed at the same time as the Earth, are roughly 4.56 billion years old, so this figure is generally taken to be the age of the Earth.

Geologists have observed layers of rock throughout the world, each with a unique set of fossils and a sequence of dates extending back from the present to the formation of the Earth, as mentioned above. Each of these epochs has been dated, typically to many millions of years ago, in numerous studies. For example, the Cambrian explosion, when many skeletal organisms arose, has been dated as occurring over a period of roughly 20 million years, starting 541 million years ago. Similarly, the Cretaceous-Tertiary meteorite impact, which evidently killed off the last of the dinosaurs, occurred 66 million years ago. A listing of the currently understood geologic time scale can be found in any recent geology text, or in the Wikipedia article on the topic.<sup>11</sup>





#### 4. How reliable are these geologic dates?

The figures mentioned above are based on *radiometric dating*, which is based on radioactive decay of certain nuclear isotopes. Radioactive decay is a very basic physical phenomenon, well understood as a consequence of quantum mechanics. Quantum mechanics is, in turn, one of two cornerstones of modern physics (the other is general relativity), having been precisely confirmed in thousands of very exacting experiments.

Some question if scientists can be certain that rates of radioactive decay have been constant over geologic time, but in addition to the deduction from quantum mechanics that they are constant, empirical studies have confirmed this hypothesis in several ways. For instance, when astronomers view a supernova exploding in a distant galaxy, say, a hundred million light-years away, they see the process of radioactivity and the action of the laws of quantum mechanics in exquisite detail, indistinguishable from experiments in Earth-based laboratories. Yet that supernova explosion actually occurred a hundred million years ago. In other words, a telescope is a “time machine” of sorts, permitting one to see the laws of physics in operation eons ago and to verify that these laws have not changed significantly from what we see in operation today.

For these reasons, scientists have considerable confidence in radiometric dating when used in accordance with procedures that have been developed and refined over several decades. During the 1950s and 1960s, when these schemes were first being developed, one could assert “reasonable doubt” on these dates, but the same cannot be said today. Details on how these dates are measured and calculated, and why scientists consider them to be so reliable have been discussed elsewhere.<sup>12, 13, 14</sup>

**5. Since there are potential difficulties with radiocarbon dating, doesn't this draw into question scientists' dating of geologic eras?**

Radiocarbon dating, also known as carbon-14 dating, is a particular form of radiometric dating. It is based on the fact that when a plant or animal organism dies, it stops ingesting carbon-14, and the amount of carbon-14 gradually decreases, with a half-life of approximately 5,730 years. Because of this relatively short half-life, radiocarbon is useful for dating artifacts of a relatively recent vintage, as far back as roughly 50,000 years before the present.

Radiocarbon dating, like any empirical procedure, is indeed subject to certain errors and anomalies. For example, in 1969 scientists found that previous published measurements needed to be corrected, due to a factor now well understood. Recently the radiocarbon scale was accurately calibrated based on analyses of sediment layers.<sup>15</sup> But in any event, potential difficulties with radiocarbon dating have no bearing on one way or the other on the age of the Earth or the ages of any of the major geologic eras. This is because radiocarbon measurements are limited to specimens no older than 50,000 years in age. Other radiometric techniques must be used beyond this point.

**6. How can we reconcile geologic dates with scripture?**

Much has been written attempting to reconcile geologic dates with scripture. Some, mostly of conservative Protestant backgrounds, have insisted that the Earth was created in six 24-hour days.<sup>16</sup> Others, including Elder Bruce R. McConkie, for instance, have taught that the physical creation lasted six thousand years, based on each day of creation being a day "according to Kolob"<sup>17</sup> (although Elder McConkie later wrote that each day was "an age, an eon, a division of eternity").<sup>18</sup>

Still other LDS authorities have opted for a more expansive time frame, more in keeping with modern science. In 1844, W. W. Phelps wrote that eternity has been going on in this system for 2,555,000,000 years, a figure evidently derived by reckoning each day of the 6,000 years to be a day according to Kolob ( $6,000 \times 365 \times 1,000 = 2,555,000,000$ ).<sup>19</sup> Brigham Young took a more open-ended position on the issue:

As for the Bible account of the creation, we may say that the Lord gave it to Moses, or rather Moses obtained the history and traditions of the fathers, and from these picked out what he considered necessary, and that account has been handed down from age to age, and we have got it, no matter whether it is correct or not, and whether the Lord found the earth empty and void, whether he made it out of nothing or out of the rude elements; or whether he made it in six days or in as many millions of years, is and will remain a matter of speculation in the minds of men unless he give revelation on the subject.<sup>20</sup>

In the April 2000 LDS General Conference, Elder Russell M. Nelson was similarly noncommittal: "In Genesis and Moses, those periods are called days. But

in the book of Abraham, each period is referred to as a time. Whether termed a day, a time, or an age, each phase was a period between two identifiable events — a division of eternity.”<sup>21</sup>

In short, from all evidence, the LDS Church does not officially state the age of the Earth nor by what specific means it was created. For example, the article “Age of the Earth” in the *Encyclopedia of Mormonism*, which was produced with careful consultation with senior LDS authorities, starts with the noncommittal statement, “The scriptures do not say how old the earth is, and the Church has taken no official stand on this question. ... Nor does the Church consider it to be a central issue for salvation.”<sup>22</sup>

### **7. Isn’t evolution just a “theory”?**

Merriam-Webster’s Dictionary lists several definitions for the word “theory,” including (a) “a plausible or scientifically acceptable general principle or body of principles offered to explain phenomena, e.g., the wave theory of light” and (b) “a hypothesis assumed for the sake of argument or investigation; an unproved assumption.” In most scientific discourse, scientists use definition (a), whereas in popular public discourse, definition (b) is more widely assumed. This distinction is the root of the widespread misunderstanding of the phrase “theory of evolution.”

Evolution is not termed a “theory” because it is a sketchy conjecture that has never been seriously tested. To the contrary, evolution has passed more than a full century of rigorous empirical tests. It is termed a “theory” in the same sense that one refers to “atomic theory” or “theory of relativity” or “theory of equations,” because it is a general principle with substantial explanatory power and falsifiability that has withstood rigorous scrutiny.

On the other hand, most scientists are content with the double meaning of “theory” as a form of self-imposed humility and resistance against taking any theory as unchangeable truth. The tentative nature of scientific theories was impressed on scientists most vividly in the early twentieth century, when Newton’s classical laws of motion and gravitation, which had dominated scientific research for more than three centuries, were displaced by Einstein’s relativity (for objects traveling at very high speeds) and by quantum mechanics (for very small objects, such as atoms and subatomic particles). Thus even well-established theories such as evolution may need to be modified as more and more experimental evidence is accumulated (although it is exceedingly unlikely that any of its major precepts will be found in error).

### **8. Does the Second Law of Thermodynamics contradict the theory of evolution?**

Some creationists have argued that the Second Law of Thermodynamics refutes the theory of evolution. This law states that the level of disorder (made suitably precise) of an isolated system that is not in equilibrium will tend to increase over time. At



a fundamental level, this is really a statement about probability. For example, if billiard balls are placed on a billiard table in the triangle frame and scattered by a cue, it is overwhelmingly likely that when they all stop moving, they will be in a rather “random” configuration rather than, say, all in one corner.

However, there is a severe fallacy in applying this principle to evolution. A key condition of the Second Law is that the system being described is a “closed system,” in particular one that has no influx or outflow of ordered energy. However, the Earth’s biosphere is definitely not a “closed system.” To the contrary, every day the Earth receives a prodigious amount of highly ordered energy from the Sun, an amount that is roughly 10,000 times the total daily energy consumption of the entire present-day human civilization. Indeed, biology can be seen as a process that extracts ordered energy from the environment to create order and complexity in living things. So the Second Law really doesn’t apply one way or the other to biological evolution.

### **9. Aren’t there gaps in the fossil record that disprove evolution?**

Those who question evolution as a means for the physical creation often cite gaps in the fossil record. Creationist Henry Morris, for instance, asserts that there are “systematic gaps” in the fossil record, and “There is no evidence that there have ever been transitional forms between these basic kinds.”<sup>23</sup>

It is undeniably true that gaps exist in the fossil record, but such gaps are natural and predictable. Almost all biological organisms that have ever lived were either eaten by predators or otherwise destroyed soon after death, leaving no trace. Most that persisted in some form (e.g., as skeletons) were later destroyed by chemical effects or were part of a geological layer that subsequently disappeared into the Earth’s molten mantle. Almost all fossils that have survived these and numerous other perils lie far beneath the Earth’s surface and will never be seen by humans. Thus the fossil record will never be “complete” — all we can expect is to capture glimpses of the Earth’s flora and fauna over its multi-billion-year history.

Also, in discussing this issue, one first must carefully define terms. By “gap,” does one mean a “gap” that had been identified in Darwin’s time, one that was identified say in the 1950s, or one that exists now? And if a transitional fossil is found within a given gap, does that mean two more gaps have suddenly appeared and must be filled (one on each side)?

In any event, it is simply not true that no transitional fossils have been found. At least one if not more transitional fossils have been found for virtually all gaps thought to exist in Darwin’s day, and even most of the “gaps” known 50 years ago have been filled with the discovery of transitional fossils.<sup>23</sup>

For example, scientists once despaired ever finding transitional fossils linking the hypothesized link between ancient land mammals and marine mammals (e.g.,



orcas, whales, and dolphins). But within the last two or three decades, at least thirty intermediate fossil species have been found with exactly the expected combination of terrestrial and aquatic features.<sup>25</sup> As another example, in 2004 researchers discovered the “Tiktaalik” fossil in a remote area of Ellesmere Island, above the Arctic Circle in Canada. It spans the transition between ancient fish and the earliest four-legged creatures.<sup>26</sup>

In summary, while it is undeniably true that gaps exist in the fossil record, so many transitional fossils have been found in recent years that it is not clear that the “gap issue” has any force against evolutionary theory. For additional discussion, see Bailey 2013c.

#### **10. What does DNA evidence say about evolution?**

In the past few years, modern genome sequencing and computer technology have placed an enormous volume of DNA data only a mouse-click away from researchers worldwide. The first complete human genome sequence was completed in 2000, after a ten-year effort that cost over \$500 million. But now genomes can be sequenced at a cost of \$1,000.<sup>28</sup> Thus it is inevitable that genome sequencing will become a standard part of modern medicine. But this same sequencing technology has enabled biologists to study the genomes of thousands of other biological species, including many common (and not-so-common) plants and animals, thus permitting evolution to be studied at the most basic level. In particular, DNA sequence analysis provides a new means, independent of studies of comparative anatomy and other methods used in the past, to quantitatively measure the evolutionary “distance” between species and, hence, to convincingly arrange species in an evolutionary family tree.

One example of DNA-type data is the table below, which compares the 146-unit amino acid sequences of beta globin (a component of hemoglobin) among various species of animals. Amino acids are coded directly by triplets of DNA letters, and thus the study of amino acid sequences is very close to the study of DNA sequences themselves. In the table below, note that human beta globin is identical to that of chimpanzees, differs in only one location from that of gorillas, yet is increasingly distinct from that in red foxes, polar bears, horses, rats, chicken, and salmon. Anyone with an Internet connection can generate similar data using online tools and databases.<sup>29</sup>

The picture is the same if we consider the pattern of mutations between closely related species. For example, the gene that when mutated results in cystic fibrosis in humans is nearly identical to the corresponding gene in chimpanzees but is progressively less similar to the corresponding gene in orangutans, baboons, marmosets, lemurs, mice, chicken and puffer fish.<sup>30</sup> As yet another example, Cytochrome C, which is essential for cell respiration, differs only in one location out of 104 between humans and rhesus monkeys. Comparing humans and horses, there are twelve differences; comparing rhesus monkeys with horses, there are eleven differences. Evidently the single difference between humans and rhesus monkeys occurred after our hominid ancestors split from the lineage that led to present-day monkeys.<sup>31</sup>

**PERCENT AGREEMENT BETWEEN HEMOGLOBIN OF VARIOUS SPECIES**

	Human	Chimp	Gorilla	Red Fox	Polar Bear	Horse	Rat	Chicken	Salmon
Human	100.	100.	99.3	91.1	89.7	83.6	81.5	69.2	49.7
Chimp	100.	100.	99.3	91.1	89.7	83.6	81.5	69.2	49.7
Gorilla	99.3	99.3	100.	91.8	90.4	82.9	80.8	68.5	49.0
Red Fox	91.1	91.1	91.8	100.	95.2	80.8	80.1	72.6	49.7
Dog	89.7	89.7	90.4	98.6	94.5	80.1	79.5	71.2	49.0
Polar Bear	89.7	89.7	90.4	95.2	100.	80.8	82.9	71.9	48.3
Horse	83.6	83.6	82.9	80.8	80.8	100.	76.0	67.8	46.3
Rat	81.5	81.5	80.8	80.1	82.9	76.0	100.	65.8	49.7
Chicken	69.2	69.2	68.5	72.6	71.9	67.8	65.8	100.	54.4
Salmon	49.7	49.7	49.0	49.7	48.3	46.0	49.7	54.4	100.

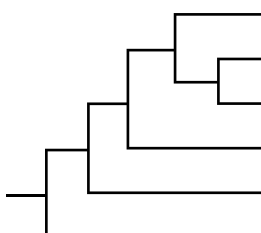
Another interesting example is the “GULO” gene, which is an essential part of the biochemical machinery that makes Vitamin C in animals. Humans lack a functioning copy of this gene — our copy is mutated — and scurvy results when we don’t get enough Vitamin C in our diet. But although the human GULO gene is mutated and useless, humans and chimpanzees have very similar copies of it (98% identical). Evidently a common ancestor of humans and chimps adopted a diet

rich in fruits and vegetables, and thus a chance mutation that disabled Vitamin C production was not deleterious and was passed on to posterity.<sup>32</sup>

One additional item of evidence for evolution comes from examining “transposons” or “jumping genes.” These are sections of DNA that have been randomly copied from one part of an organism’s genome to another. Most of the time, these inserted genes do no damage because they “land” in relatively unimportant sections of DNA. But they do provide an excellent means to classify species into their phylogenetic (“family tree”) relationships. This is because it is exceedingly unlikely that the same random insertion of an entire gene would occur at the same spot in the genomes of two or more different organisms or species unless, of course, each inherited this curious feature from a common ancestor. It is also exceedingly unlikely that a group of species with “random” assortments of transposons could be organized into a family tree. The chart below is an example of how transposon data can be used to determine the phylogenetic relationships of various primates. The columns labeled ABCDE denote five blocks of transposons, and x and o respectively denote that the block is present or absent. It is clear from this data that our closest primate relatives are chimpanzees and bonobos.<sup>33</sup>

### 11. Doesn’t probability refute evolution?

Probability arguments are often employed in criticisms of biological evolution. Writers argue that certain features of biology are so improbable that they could never have been produced by a purely natural, “random” process. They often equate the hypothesis of evolution to the absurd suggestion that monkeys randomly typing at a typewriter could compose a selection from the works of Shakespeare or that an explosion in an aerospace equipment yard could produce a working 747 airliner.

TRANSPOSON BLOCKS						
	Species	A	B	C	D	E
	Human	o	x	x	x	x
	Bonobo	x	x	x	x	x
	Chimp	x	x	x	x	x
	Gorilla	o	o	x	x	x
	Orangutan	o	o	o	x	x
	Gibbon	o	o	o	o	x

One such argument goes like this: the human alpha-globin molecule, a component of hemoglobin that performs a key oxygen transfer function, is a protein chain based on a sequence of 141 amino acids. There are twenty different amino acids common in living systems, so the number of potential chains of length 141 is

$20^{141}$ , which is roughly  $10^{183}$  (i.e., a one followed by 183 zeroes). These writers argue that this figure is so enormous that even after billions of years of random molecular trials, no human alpha-globin protein molecule would ever appear.<sup>34, 35</sup>

One difficulty in this particular argument is that it ignores the fact that a large class of alpha-globin molecules can perform the essential oxygen transfer function. Indeed, most of the 141 amino acids in alpha-globin can be changed without altering the key oxygen transfer function, as can be seen by noting the great variety in alpha-globin molecules across the animal kingdom (see the previous item). When one revises the calculation above, based on only twenty locations essential for the oxygen transport function (which is a generous over-estimate), one obtains  $10^{33}$  fundamentally different chains, a huge figure but vastly smaller than  $10^{183}$ .<sup>36</sup>

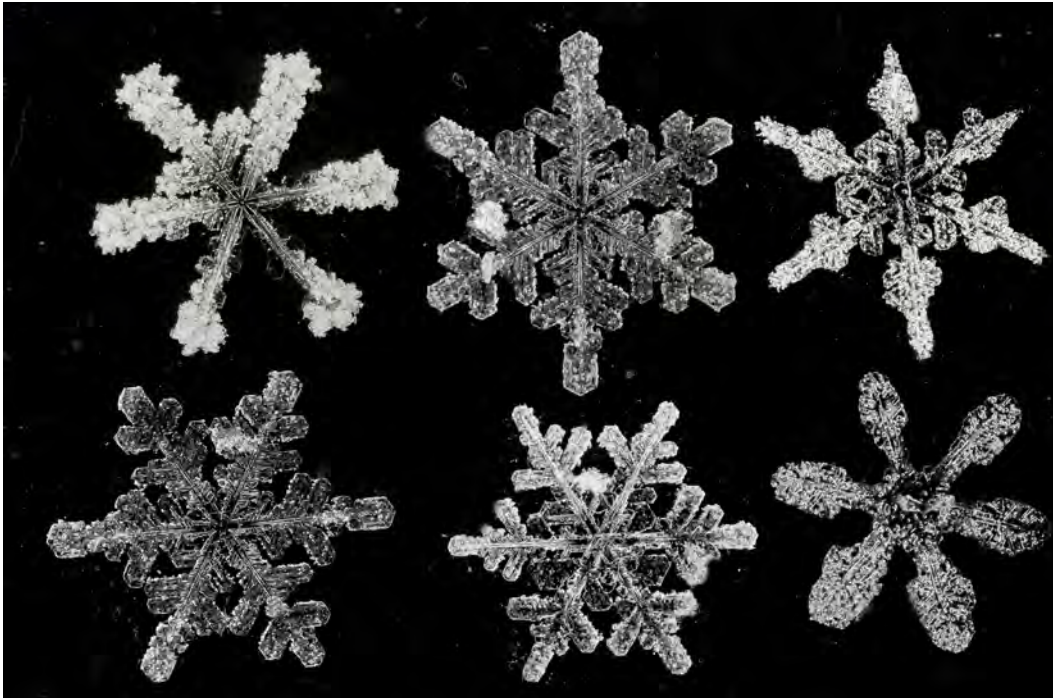
But even after this revision, the calculation still suffers from the fatal fallacy of presuming that a structure such as human alpha-globin arose by a single all-at-once random trial event (which, after all, is the creationist theory, not the scientific theory, of its origin). Instead, available evidence from many published studies on the topic suggests that alpha-globin and other proteins arose as the end product of a long sequence of intermediate steps, each of which was biologically useful in an earlier context.<sup>37</sup> Thus any simple probability calculation (whether it is arguing for or against some aspect of evolution) that does not take into account the step-by-step process by which the structure came to be is not meaningful and can easily mislead.<sup>38, 39</sup>

Some of the potential difficulties with probability arguments can be illustrated by considering snowflakes. Bentley and Humphrey's book *Snow Crystals* includes over 2,000 high resolution black-and-white photos of real snowflakes, each with intricate yet highly regular patterns that are almost perfectly six-way symmetric (Bentley, 1962). Four of Bentley's photos are shown below. By employing a reckoning based on six-way symmetry, one can calculate the chances that one of these structures can form "at random" as roughly one part in  $10^{2500}$ . This probability figure is even more extreme than those mentioned above. So is this proof that each individual snowflake has been designed by a supernatural intelligent entity? Obviously not.

The fallacy here, once again, is presuming an all-at-once random assembly of molecules. Instead, snowflakes, like biological organisms, are formed as the product of a long series of steps acting under well-known physical laws, and the outcomes of such processes very sensitively depend on the starting conditions and numerous environmental parameters.

In short, a process as complicated as the evolution of life on Earth, over many millions of years, involving millions of species and many more biomolecular structures, cannot be reduced to simple probability calculations. The theory of evolution may indeed have weaknesses and may eventually need to be revised, but this will require more sophisticated arguments and better empirical evidence than provided by probability-based arguments.<sup>40</sup>





## 12. Does “irreducible complexity” pose a serious challenge to evolutionary theory?

Intelligent design scholar Michael Behe has argued that certain biological systems, including bacterial flagella, blood clotting machinery, and the vertebrate immune system, are “irreducibly complex” — they consist of multiple subsystems, the removal of any one of which would render the system nonfunctional. He argues that such systems must have been designed by an intelligent entity because none of the components could have evolved in the absence of the others.<sup>41</sup> Behe illustrates irreducible complexity with a mousetrap, which consists of a platform, spring, hammer, hold-down bar, and catch. If any of these parts is removed, the mousetrap cannot function to catch mice. Thus it must have been designed.

But as with probability-based arguments, there are significant difficulties with such reasoning. Scientists note that the components of “irreducibly complex” systems can arise by natural evolution because they may arise separately, each useful in different context, and later be combined into a larger system. With regard to Behe’s example of the bacterial flagella, researchers recently found that its DNA sequence is almost identical to that of a “needle” that certain bacteria use to insert toxins.<sup>42</sup> Biologist Kenneth Miller has shown in addition that several components of the flagellum have other functions.<sup>43</sup>

Another example frequently mentioned by both creationist and intelligent design writers is the human eye. They insist that a high-resolution light gathering system such as the retina would be useless without a lens and vice versa. Yet even Charles Darwin proposed a multi-step scenario of how eyes might have developed, beginning with a photosensitive cell, progressing to an optic nerve surrounding

pigment cells, and finally concluding with muscles that could contract around the lens. What's more, within the animal kingdom one find can a wide range of eye designs, including numerous instances that are significantly better than human eyes. Octopuses and other mollusks, for example, have optic nerves that emerge from the back of the retina, thus avoiding the blind spot that afflicts human vision. Similarly, hawks have a visual acuity rating of 20/5, significantly better than the 20/20 vision of humans. Owl eyes are 50 to 100 times more sensitive to light at nighttime than are human eyes.<sup>44</sup>

In a similar way, scientists have found that most of the proteins involved in the blood clotting system are genetically similar and most likely are the result of gene duplication.<sup>45</sup> Thus while Behe's notion of "irreducible complexity" is intriguing, it is not clear that any solid examples have yet been identified that pose a serious challenge to evolution.

In a larger sense, it is not clear that highly technical issues such as probability calculations or "irreducible complexity" have any proper place in discussions of science and religion.

### 13. Can evolution generate truly novel biological features?

One central issue in the debate over evolution is the question of novelty — can evolution produce truly novel features? The consensus of biologists is that it can. Here are some examples:

- a. *1974 E. coli experiment.* In a 1974 paper Barry Hall and Daniel Hartl identified a gene in the bacterium *E. coli* that is responsible for metabolizing lactose, using a complicated three-part process. They removed this gene, and then permitted the bacteria to multiply in a stressed environment containing lactose. Within 24 hours the bacteria had evolved a capability to utilize lactose, by means of a similar but distinct three-part biochemical pathway, involving two mutated genes.<sup>46</sup>
- b. *1994 E. coli result.* Biologist Richard Lenski and his colleagues have been conducting a long-running experiment on bacterial evolution that began in 1988. Starting with twelve flasks of *E. coli* bacteria, identical except for some neutral markers, they have followed the course of these bacteria for 45,000 generations. As the generations continued, each of the twelve lines grew progressively better at processing glucose. Examining the results after 20,000 generations, the experimenters found that two of the twelve lines had independently "discovered" virtually the same improved scheme for glucose metabolism. Later in the experiment, shortly after generation 33,000, the average population of one of the lines shot up by a factor of six above the others. The investigators found that this line had developed the ability to utilize citrate by means of a remarkable combination of two distinct mutations.<sup>47</sup>
- c. *Japanese nylon-eating bacteria.* In 1994, Japanese biologists discovered a bacterial species that thrives in nylon waste. It turns out that these bacteria had undergone a "frame shift" mutation, in which an extra base pair had been inserted into the bacteria's DNA that by remarkable chance endowed the

- bacteria with the facility to metabolize nylon.<sup>48</sup>
- d. *The Milano mutation*. Scientists recently discovered that certain persons in an Italian community, all descended from a single individual several generations back, possess a genetic mutation that increases good cholesterol and provides an effective antioxidant, thus resulting in measurably improved cardiovascular health.<sup>49</sup>
  - e. *Antibiotic-resistant diseases*. Perhaps the best-known examples of evolution in action are, sadly, the recent evolution of new strains of tuberculosis that are resistant to all known anti-TB drugs. By analyzing DNA sequences, researchers have identified at least six different families of tuberculosis, at least one of which appears to be evolving on an unexpected and potentially very dangerous path.<sup>50</sup> Another example is drug-resistant strains of HIV. Researchers are devising strategies, such as keeping “second-line” treatments in reserve for patients who do not respond to “first-line” treatments.<sup>51, 52</sup>

#### **14. Is there evidence that species (including humans) have been individually designed?**

Writers in the creationism and intelligent design community have argued that each individual “kind” has been separately created and/or designed in detail by an intelligent being. They cite intricate, well-adapted features of biological organisms, including humans, as evidence of this designer, which is usually identified as the Judeo-Christian God.<sup>53</sup> But others caution that it is not wise to base one’s religious faith on this type of argument, since “design” is a two-edged sword.

To begin with, the design hypothesis by itself fails to explain the pain, violence, suffering and other defects that are often seen in the natural world. And it does not seem right to suggest that God meticulously “designed” individual species by the millions, only to see virtually all of them ultimately fall into extinction.

For example, as mentioned above, Vitamin C (ascorbic acid) is required for a wide range of essential metabolic reactions, and scurvy, that scourge of British sailors and Mormon pioneers, occurs in humans when they do not get enough Vitamin C. Yet while almost all mammals generate their own Vitamin C, and although humans have the same overall biochemical machinery, it doesn’t work because mutations have inactivated a key step.<sup>54</sup> Thirty percent of the roughly 1,000 human genes associated with the sense of smell are inoperable due to accumulated mutations.<sup>55</sup> Finally, in the eyes of humans and other mammals, the optic nerves emerge from the front of the retina and travel to the back, resulting in a blind spot. By contrast, the eyes of cephalopods (including the octopus, squid, cuttlefish, and nautilus) are designed more logically with nerve connections on the back of the retina.<sup>56</sup>

So did God meticulously “design” humans with these specific defects and vulnerabilities, or did he, at a higher level, create the world and a system of elegant and immutable laws that are conducive to the formation of living creatures, including us? And is it not our sacred duty to utilize the scientific method to understand

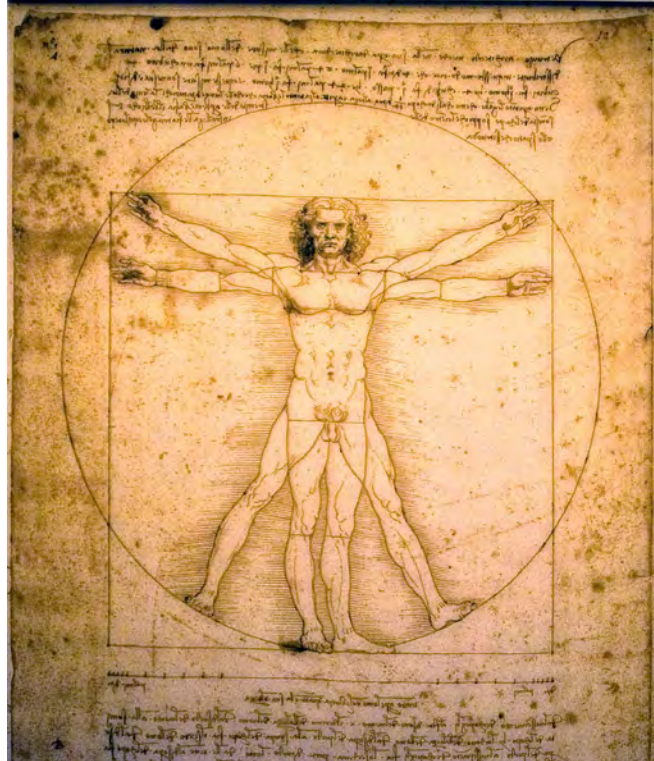


*The Vitruvian Man*, ca. 1490  
Leonardo da Vinci, 1452 - 1519

these problems, and, where possible, counter their effects and mitigate the suffering that results from them?<sup>57</sup>

### 15. Did God employ evolution for the physical creation?

Some are reluctant to accept the notion that God employed evolution indirectly as the means for the creation, preferring instead a direct, “hands-on” creation.<sup>58</sup> One traditional objection has been the issue of time frame



required for an indirect creation via evolution. But as we have seen above, there is no fundamental theological reason that the days of creation could not be much longer eras, and, quite frankly, the evidence for a multi-billion-year creation is very strong.

Along this line, it is interesting to note that the Bible itself often uses similar indirect, figurative language to refer to God’s creation. For example, Psalm 139:13-16 declares that God formed me “in my mother’s womb. I will praise thee, for I am fearfully and wonderfully made (*asah*). ... My substance (bone frame) was not hidden from thee, when I was being made (*asah*) in secret.” Isaiah 44:24 describes God as the one who “formed (*yatsar*) thee from the womb,” and Isaiah 49:5 says, “And now, saith the Lord that formed (*yatsar*) me from the womb to be his servant.” Similarly, Isaiah 44:2 declares, “Thus saith the Lord that made (*asah*) thee and formed (*yatsar*) thee from the womb.”

Clearly no one, certainly not the ancient Hebrews, thought that God literally, hands-on, created babies bone-by-bone in their mother’s womb. Yet the Hebrew words *asah* and *yatsar* used in these passages are the same words that are used in Genesis to describe God’s creation of the sun, stars, plants, animals, and humans.<sup>59</sup>

### 16. What have religious leaders said about evolution?

Most large Judeo-Christian denominations have made their peace with science in general. Some, particularly in the evangelical Protestant community, are opposed to evolution, but larger denominations generally accept the principle without going

into detail on particular aspects of this or any other major theory. For example, Pope John Paul II declared:

Today, ... some new findings lead us toward the recognition of evolution as more than an hypothesis. In fact it is remarkable that this theory has had progressively greater influence on the spirit of researchers, following a series of discoveries in different scholarly disciplines.<sup>60</sup>

In 1909, the LDS First Presidency released a statement entitled “The Origin of Man.” It included the following passage:<sup>61</sup> “It is held by some that Adam was not the first man upon this earth, and that the original human being was a development from lower orders of the animal creation. These, however, are the theories of men.” However, a few months later, in 1910, an editorial by the First Presidency in the *Improvement Era* addressed the question, “In just what manner did the mortal bodies of Adam and Eve come into existence on this earth?” The editorial responded, after citing some basic creation scriptures:

Whether the mortal bodies of man evolved in natural processes to present perfection, through the direction and power of God; whether the first parents of our generations, Adam and Eve, were transplanted from another sphere, with immortal tabernacles, which became corrupted through sin and the partaking of natural foods, in the process of time; whether they were born here in mortality, as other mortals have been, are questions not fully answered in the revealed word of God.<sup>62</sup>

In 1925, the First Presidency released a statement “Mormon View of Evolution.”<sup>63</sup> This statement was essentially a shortened and edited version of the 1909 statement, although it did not include the text, mentioned above, on whether humans developed from earlier species.

In 1930, Elders Joseph Fielding Smith, Brigham H. Roberts, and James E. Talmage were debating the issue of whether there were “pre-Adamites” or other creatures before the fall of Adam. Elder Smith argued against the possibility of pre-Adamites, or, in a larger sense, of any evolution, a view that he later expanded in his book *Man: His Origin and Destiny*.<sup>64</sup> Elder Roberts countered that we should pay attention to findings of scientific research, a view that he elaborated on in his 1931 manuscript *The Truth, the Way, the Life*:

On the other hand, to limit and insist upon the whole of life and death to this side of Adam’s advent to the earth, some six or eight thousand years ago, as proposed by some, is to fly in the face of the facts so indisputably brought to light by the researcher of science in modern times.<sup>65</sup>

Elder Talmage’s view is indicated by the following, from a 1931 talk published by the Church:

According to the conception of geologists the earth passed through ages of preparation, to us unmeasured and immeasurable, during which countless generations of plants and animals existed in great variety and profusion and gave

in part the very substance of their bodies to help form certain strata which are still existent as such. ...

Geologists say that these very simple forms of plant and animal bodies were succeeded by others more complicated; and in the indestructible record of the rocks they read the story of advancing life from the simple to the more complex, from the single-celled protozoan to the highest animals, from the marine algae to the advanced types of flowering plant — to the apple-tree, the rose, and the oak.

What a fascinating story is inscribed upon the stony pages of the earth's crust!<sup>66</sup>

After several manuscripts were circulated, the First Presidency subsequently concluded that additional debate would be fruitless and sent a letter to all Church leaders that concluded:

Upon the fundamental doctrines of the Church we are all agreed. Our mission is to bear the message of the restored gospel to the people of the world. Leave geology, biology, archaeology and anthropology, no one of which has to do with the salvation of the souls of mankind, to scientific research, while we magnify our calling in the realm of the Church.<sup>67</sup>

In 1958, Elder Bruce R. McConkie published the first edition of his book *Mormon Doctrine*. Among the entries was an article on evolution that concluded, "There is no harmony between the truths of revealed religion and the theories of organic evolution."<sup>68</sup> President McKay asked a committee consisting of Elders Mark E. Petersen and Marion G. Romney to review the book. They reported numerous areas of concern, including the treatment of "evolution and evolutionists,"<sup>69</sup> although the article on evolution remained in the second edition.

According to several accounts, President McKay personally accepted evolution,<sup>70</sup> although he never openly taught this view. He did, however, briefly mention the "millions of years of the earth's existence" in talks to BYU students,<sup>71</sup> and he mentioned "evolution's beautiful theory of creation" both in a 1952 BYU talk<sup>72</sup> and later, using nearly the same language, in a 1968 general conference talk.<sup>73</sup>

In 1991, as part of the compilation of the *Encyclopedia of Mormonism*, the editors referred the question of evolution to President Gordon B. Hinckley. He forwarded to them a copy of the 1931 First Presidency letter mentioned above, together with a draft of a short article. The text of the resulting article, which is almost word-for-word what President Hinckley provided, includes the passage, mentioned above, "Leave geology, biology, archaeology and anthropology, no one of which has to do with the salvation of the souls of mankind, to scientific research, while we magnify our calling in the realm of the Church."<sup>74</sup>

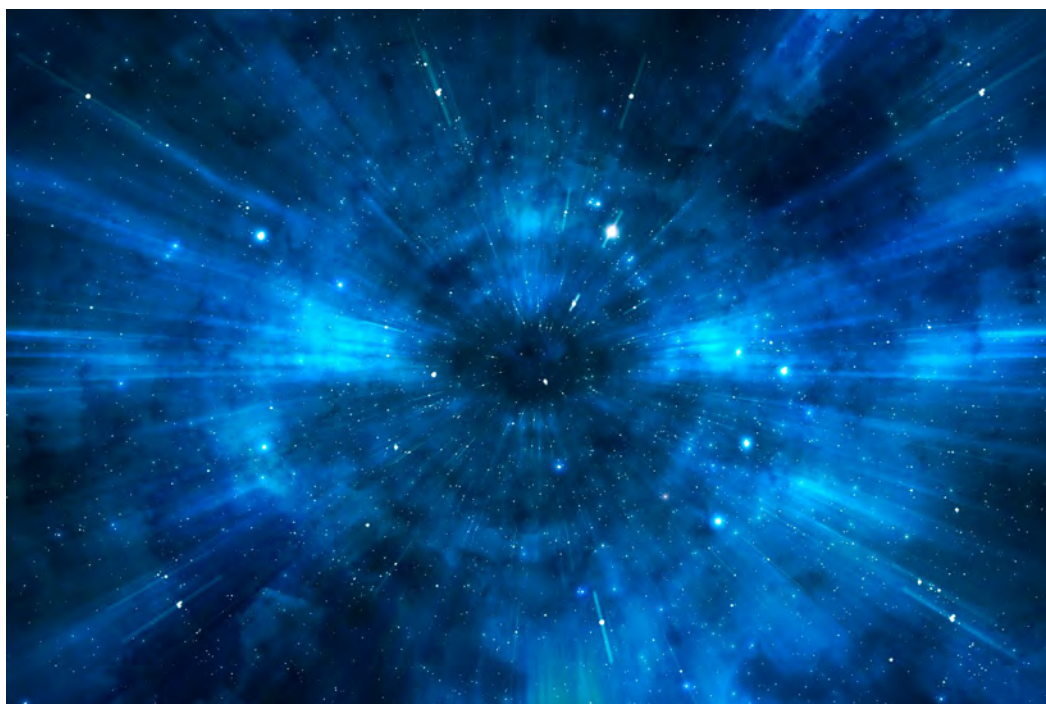
Finally, in 1992, the BYU Board of Trustees and the First Presidency approved what is known as the BYU Packet on "Evolution and the Origin of Man." It includes the 1909 statement, a 1910 First Presidency comment, the 1925 statement, and the

1992 *Encyclopedia of Mormonism* article.<sup>75</sup> As far as I am aware, the BYU Packet is the latest word on the LDS Church's "official" view of evolution.

### 17. What is the evidence for the big bang cosmology?

"Big bang cosmology" is a name given to the big bang, which scientists now date at 13.8 billion years ago, and the evolution of the universe since the big bang. In 1924, American astronomer Edwin Hubble measured the distance to nearby spiral nebulae and showed that these systems were actually other galaxies, not merely objects within the Milky Way. In 1927, Georges Lemaitre, a Belgian Roman Catholic priest, argued that the recession of these nebulae was due to the expansion of the fabric of universe, in consequence of Einstein's general theory of relativity. In 1929, Hubble confirmed this hypothesis, by showing that the distances to these galaxies were roughly proportional to their outward velocities, as measured by their red shift (this fact is now known as Hubble's Law). This implied that the entire universe is expanding, not only away from us but also away from every other position in space, much like dots on the surface of an expanding balloon all appear to be moving away from each other. Thus, there must have been a time when the universe was very much denser than it is today.

The big bang cosmology received substantial confirmation from an important discovery in 1964. Two radio astronomers used a large antenna at Bell Laboratories in New Jersey to make some measurements of radio waves. After fruitlessly trying to eliminate background noise, they finally realized that this noise was emanating from the sky. Physicists at nearby Princeton University quickly recognized that this noise must be the primordial echo of the universe itself from 300,000 years after the



big bang, since the spectrum of the noise fit a “black body” radiation curve that had been predicted earlier by theoreticians.<sup>76</sup>

At about the same time, theoretical calculations by researchers concluded that the big bang would have produced a universe that is roughly 75% hydrogen and 25% helium, with traces of other elements. Measurements verified these figures in impressive detail.<sup>77</sup>

More recent astronomical measurements continue to confirm the big bang theory. For example, in 1993 measurements of the cosmic microwave background using the Cosmic Microwave Background Explorer (COBE) satellite were found to fit perfectly a black body radiation curve with a characteristic temperature of 2.725 K, plus or minus 0.01 K. Data obtained from the Wilkinson Microwave Anisotropy Probe (WMAP) spacecraft, which was in operation from 2001 through 2010, showed even more spectacular agreement — plus or minus 0.001 K. These measurements have also found that this radiation is equal in all directions to within one part in 100,000. Interestingly, in the early 1990s fluctuations were found lower than this level, at just the amount predicted by theory to account for the “lumpiness” of the present universe.<sup>78</sup>

Given such impressive agreement with theory in multiple tests, the big bang cosmology is now widely accepted. However, some questions remain. One of these regards the “inflation” scenario, namely the theory that the universe underwent a spectacular expansion by some 30 orders of magnitude during the first tiny fraction of second after the big bang. This explains many curious features of our present universe, such as why different parts of the universe, from our vantage point, appear to have the same characteristics, even though they could not have had any “communication” between them since the big bang. However, more recent studies are starting to raise serious questions about the inflation scenario, so we may well see it significantly revised in the coming years.<sup>79</sup>

## **18. What are the “cosmic coincidences”?**

Some of the most remarkable findings of modern physics and cosmology are the “cosmic coincidences,” namely indications that our particular universe and its laws seem remarkably fine-tuned for the rise of intelligent life. For example, if gravitation had been very slightly stronger in the early universe, the expansion would have stopped and even reversed long ago, ending the universe in a big crunch long before any intelligent creatures would have arisen. On the other hand, if gravitation had been very slightly weaker, stars and galaxies might not have formed until matter was too dispersed, leaving the universe a cold and lifeless place.

A few of these cosmic coincidences that have been noted in previous years now have reasonable explanations, but numerous other coincidences remain inexplicable, and, if anything, recent developments in physics and astronomy have compounded these mysteries. They have even led some leading scientists to

propose the controversial “anthropic principle”: the reason we see these cosmic coincidences is that if the universe weren’t constructed in a very special way, we would not be around to discuss the issue.<sup>80</sup> Other writers see the hand of God in these coincidences.

Here are just a few of the coincidences that have been noted in the scientific literature:

- a. *Carbon resonance and the strong force.* As mentioned above, approximately 74% of the mass in the universe is hydrogen, another 24% is helium, and all other elements comprise less than 1%. The currently understood laws of physics, coupled with the big bang cosmology, are dramatically successful in explaining these abundances. The synthesis of heavier elements, beginning with carbon, remained a mystery until 1951, when astronomer Fred Hoyle hypothesized and then discovered a nuclear “resonance” that is just energetic enough to permit carbon to form. The energy at which this resonance occurs depends sensitively on the interplay between the strong nuclear force and the weak nuclear force. If the strong force were slightly stronger or slightly weaker (by just 1% in either direction), there would be no carbon or any heavier elements anywhere in the universe, and thus no carbon-based life forms like us.<sup>81</sup>
- b. *The electromagnetic-gravitational strength ratio.* In 1974, Brandon Carter noted an interesting relationship between the ratio of the strengths of the electromagnetic and gravitational fields, which is roughly  $10^{40}$ , and the properties of stars. If gravity were slightly stronger (so that the ratio is lower), all stars would be radiative rather than convective, and planets might not form. But if gravity were somewhat weaker (so that the ratio was higher), then all stars would be convective and supernovas might not happen. Since all elements from carbon on up are synthesized in supernova explosions, there would be no carbon-based life.<sup>82</sup>
- c. *The proton-to-electron mass ratio.* The ratio of the mass of the proton to that of the electron is approximately 1836.15, according to latest measurements. The ratio of the mass of the neutron to the mass of the proton is approximately 1.0013784. In other words, the neutron’s mass is slightly more than the combined mass of a proton, an electron and a neutrino. As a result, free neutrons (neutrons that are not tied up in the nucleus of an atom) spontaneously decay with a half-life of about 10 minutes. If the neutron were very slightly less massive, then it could not decay without energy input. If its mass were lower by 1%, then isolated protons would decay instead of neutrons, and very few atoms heavier than lithium could form.<sup>83</sup>
- d. *The cosmological constant.* Perhaps the most startling “cosmic coincidence” is the fine-tuning of the cosmological constant. This paradox derives from the fact that when one calculates, based on known principles of quantum mechanics, the “vacuum energy density” of the universe, focusing on the electromagnetic force, one obtains the absurd result that empty space should “weigh”  $10^{93}$  grams per cc, whereas the actual average mass density of the universe is  $10^{-28}$  grams per cc. This is a discrepancy factor of  $10^{120}$ , i.e., a 1 followed by 120 zeroes! Physicists, who have fretted over this huge discrepancy for decades, have noted that calculations such as the above

involve only the electromagnetic force, so perhaps when the contributions of the other known forces are included, all terms will cancel out to exactly zero as a consequence of some currently unknown principle of physics.

These hopes were shattered with the 1998 discovery that the expansion of the universe is accelerating, which implies that the cosmological constant, which is tied to the vacuum energy density via Einstein's general relativity, must be slightly positive. But this means that physicists are left to explain the fact that the startling fact that the positive and negative contributions to the cosmological constant cancel to 120-digit accuracy, yet fail to cancel beginning at the 121st digit. Curiously, this observation is in accord with a prediction made by physicist Steven Weinberg in 1987, who argued from basic principles that the cosmological constant must be zero to within one part in roughly  $10^{120}$ . If not, the universe either would have dispersed too fast for stars and galaxies to have formed or else would have recollapsed long ago.<sup>84</sup>

Other examples are presented in Bailey, 2013e.

### **19. Is the fine-tuning of the universe evidence for God?**

From the previous item, we see that numerous features of our universe seem fine-tuned, often amazingly so, for the existence of intelligent life. While some physicists still hold out for a "natural" explanation, other physicists are coming to grips with the notion that our universe is profoundly "unnatural," with no good explanation other than the anthropic principle — the universe is in this extremely improbable state, because if it weren't, we wouldn't be here to discuss the fact.<sup>85</sup>

Some writers argue that these coincidences constitute proof that our universe was designed by a supreme being. But others recommend caution. Long experience has taught us that claims that one can "prove" God via arguments based on apparent design or other inexplicable phenomena in the natural world are likely to disappoint in the long run. This is the "God of the gaps" approach, which has left a legacy of disappointment as science advances. Furthermore, invoking a Creator or Designer every time unexplained phenomena arise is a "thinking stopper," burying the grand questions of science and religion in the mind of God. This may be a satisfactory theological approach, but it is not a productive scientific approach. So let's be careful here.

### **20. Is science the best approach to religious faith?**

This is an exciting time to be alive. As we have seen just from the survey above, the world of science and technology is surging ahead with remarkable discoveries on many fronts: DNA sequencing, biomedical technology, the discovery of numerous planets orbiting other stars in the "habitable zone," molecular computing, the multiverse, artificial intelligence and many others. Former LDS President Gordon B. Hinckley summarized these developments when he declared,



But in a larger sense (the twentieth century) has been the best of all centuries. In the long history of the earth there has been nothing like it. The life expectancy of man has been extended by more than twenty-five years. Think of it. It is a miracle. The fruits of science have been manifest everywhere. By and large, we live longer, we live better. This is an age of greater understanding and knowledge. We live in a world of great diversity. As we learn more of one another, our appreciation grows. This has been an age of enlightenment. The miracles of modern medicine, of travel, of communication are almost beyond belief. All of this has opened new opportunities for us which we must grasp and use for the advancement of the Lord's work.<sup>86</sup>

During these exciting times, numerous intriguing questions have emerged at the interface of science and religion. At the very least, it is inarguably true that both scientists and religious believers can stand in awe at the majesty of the universe, which is now known to be much vaster, more intricate and more magnificent than ever before realized in human history.

Nonetheless, caution is in order. For example, while discussions of evolution and cosmology may be engaging and intriguing, it is not clear that they relate in any substantive way with what most religious people experience. Was Mother Theresa inspired by the "cosmic coincidences" to devote her life to India's poor? Did Johann Sebastian Bach have the "God of the big bang" in mind when he composed over one thousand pieces of sacred music? Are millions of contemporary persons, of LDS and other religious traditions, inspired by discovery of the Higgs boson when they devote their lives to religious service? Probably not. As Holmes Rolston observed, "The religion that is married to science today will be a widow tomorrow.





... Religion that has too thoroughly accommodated to any science will soon be obsolete.”<sup>87</sup>

So while all of this may be interesting, in the end religious faith is not and cannot be either proven or disproven by science. One is still more likely to find God on his/her knees, in the soup kitchen and in living a righteous, charitable life than in the scientific laboratory. Indeed, a life of selfless charity is probably the closest we can come to true religion. As LDS President Thomas S. Monson declared:

There is a serious need for the charity that gives attention to those who are unnoticed, hope to those who are discouraged, aid to those who are afflicted. True charity is love in action. The need for charity is everywhere. ... The American educator and politician Horace Mann once said, “To pity distress is but human; to relieve it is godlike.”<sup>88</sup>

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# FORGING A FRIENDLY ALLIANCE BETWEEN MORMONISM AND SCIENCE

John W. Welch

Math and science have long been very interesting to me personally. I grew up with my slide rule often at hand in the shadow of CalTech's Jet Propulsion Laboratory in La Cañada, California, in the late 1950s during the launching of the race into space, and twenty years later in the late 1970s, I represented CalTech, Boeing, Lockheed, and Northrop as a tax lawyer in Los Angeles. In 1964 I entered BYU thinking I might major in math and ended up with a math minor. When I got admitted to do graduate work in Greek philosophy under J.C.B. Gosling at Oxford, it was because he, as my tutor, saw my background in math and wanted to pursue further ideas about Greek mathematics and Aristotelian logic. Over the years, math has made me alert to many things, including axioms, evidence,<sup>1</sup> proofs, structures,<sup>2</sup> arguments, patterns,<sup>3</sup> numbers, and numerology.<sup>4</sup> Most recently I have enjoyed the final salvo in Hugh Nibley's *One Eternal Round*, which in its final chapters connects mathematics, Egyptology, and Facsimile 2 of the Pearl of Great Price.<sup>5</sup>

In preparing this chapter, I have collected and read what I could of the literature regarding science and religion, including substantial amounts written by Latter-day Saints on this subject.<sup>6</sup> Energized by this reading, my mind has jumped to a new, quantum level of personal understanding, so to speak. At the same time, I am even more aware of the complexities of the social, political, philosophical, and practical issues that confront us here. I hope these polarizing tensions can be reduced. I am still an outsider to these conversations. Philosophy of science is not my field. I am not a Henry Eyring, let alone a Bill Nye, the Science Guy. Yet I humbly hope that I might sketch a few ideas that may point religion and science to a more constructive, synergistic, symbiotic relationship.

### Epistemological Principles Shared by Science and Mormonism

As I thought about what I might contribute to this lecture series, I was drawn to a number of very broad epistemological, metaphysical, and cosmological principles. I wondered, How many assumptions or axioms, or meta-theoretic shaping principles might be held in common by Mormonism and strong scientific theory? If we are going to forge friendly alliances between science and Mormonism, it would be helpful if we could find basic ways in which these domains have important things in common. From the following, I want to argue that Mormonism and science are not just yoked at the shoulder but are joined even deeper, at the hip.

Let's explore some of these principles.

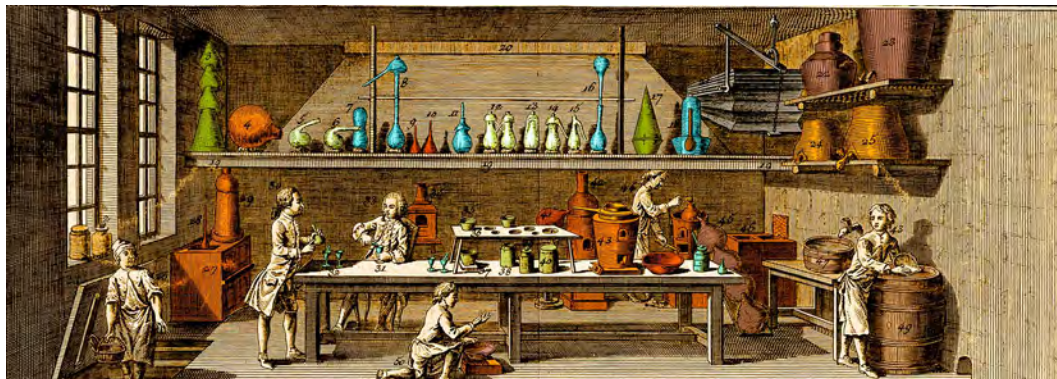


*The Milky Way*

**1. Both science and Mormonism are deeply interested in the discovery of all truth.** Many Mormon discussions of science begin with this starting point. Our desire, whether as Mormons or as scientists, is for further light and understanding, and to circumscribe all truths in one expansive whole. The early brethren made strong statements to this effect.<sup>7</sup> For example: “Mormonism includes all truth. There is no truth but what belongs to the gospel,”<sup>8</sup> and “It is our duty and calling, as ministers of the same salvation and Gospel, to *gather* every item of truth and reject every error. Whether a truth be found with professed infidels or with the Universalists ... to *gather up all the truths* in the world pertaining to life and salvation, to the Gospel we preach, to mechanism of every kind, to the sciences, and to philosophy, wherever it may be found in every nation, kindred, tongue, and people and bring it to Zion.”<sup>9</sup> Brigham Young again said: Mormonism “embraces all truth there is in all the eternities of the Gods.”<sup>10</sup> John Taylor added: “Truth, when preceded by the little word ‘all,’ comprises everything that has ever existed or that ever will exist and be known by and among men and through the endless ages of eternity; and it is the

duty of all intelligent beings ... to search after truth, and to permit it to influence them and their acts and general course in life, independent of all bias.”<sup>11</sup>

I do not know how unique this principle might be, but anyone who shares this principle with us is our friend. In both science and Mormonism, the quest for truth begins with no bounds. For Mormonism, truth is everything that endures with God in the eternities, and among other channels truth comes through revelations and confirmations by the Spirit, with Christ as the light of truth (Alma 38:9). By the power of the Holy Ghost all people may know the truth of all things (Moroni 10:5; Moses 6:61). We certainly do not know all truth yet, but someday we will.



*Eighteenth-Century Chemical Laboratory in Paris, Showing Instruments, Furnaces, Chemical Vessels, and Chemists, ca. 1760*

**2. Because Science and Mormonism seek all truth, both recognize that there are various ways to know truth.** Various subjects, tools, approaches, procedures, and methods are involved on both sides precisely because of the variety of things to be recognized, gathered, studied, measured, dissected, and analyzed. Because no one tool can yield all truth, no tool should be disregarded or excluded in our collective quest for truth, including spiritual sources.

For Latter-day Saints, D&C 88:78–79 reveals a broad curriculum involving both religion and science: “Teach ye diligently and my grace shall attend you.” One tool is diligence. Neither good science nor good religion occurs without diligence and hard work. Another tool included here is grace, or the blessings of inspiration, serendipity, and the love of God. Other aspects are mentioned, both spiritual and temporal: “... that ye may be instructed more perfectly in theory, in principle, in doctrine, in the law of the gospel, in all things that pertain to the kingdom of God, that are expedient for you to understand”; and the subject matter of this curriculum is just as broad: “of things both in heaven [astronomy] and in the earth [physics], and under the earth [geology]; things which have been [creation and cosmogony], things which are [chemistry, math, and cosmology], and things which must shortly come to pass [statistics, probability].”

**3. Both science and Mormonism explicitly embrace the experimental method.** As Dennis Rasmussen wrote in the *Encyclopedia of Mormonism*, “The LDS Church has been less inclined than some other religions to regard the world of common experience as an inferior order.”<sup>12</sup> Three times in Alma 32, vv. 27, 33, and 36, the Book of Mormon tells people to “experiment upon [Alma’s] words,” to try “the experiment,” which Amulek then calls “the experiment of its goodness” (Alma 34:4). Joseph Smith once said that the world would prove him to be a true prophet “by circumstantial evidence, *in experiments*, as they did Moses and Elijah” (TPJS 267) all this sounds like it has something important in common with the experimental methods of modern science.

It is true, as Rodney Brown points out, that Alma’s experiment will disclose the truth and goodness of the life-giving seed, while scientific experiments are designed mainly to disprove things.<sup>13</sup> But I see here more important similarities than differences. In Alma’s experiment, if the seed does not grow, one has disproved its viability, so in that sense, religious and scientific experiments are still both experiments leading to a knowledge either of or about some aspect of truth.

And concerning the alleged difference between religious and scientific experiments that scientific experiments are observable, public and repeatable, it is well worth noting that some revelations have been shared experiences, as in the cases of the Three and the Eight Witnesses, and the manifestations at the dedication of the Kirtland Temple.<sup>14</sup> The fact that spiritual experiences have occurred over and over again in my life, as in the lives of most Latter-day Saints, says something about the repeatability of spiritual experiments and manifestations. I do not know how many other religious would put it this way, but here is yet another link between Mormonism and science.

**4. Both science and Mormonism depend on theories in much the same way.** Science may call these models, while the gospel calls them plans (e.g., plan of happiness, plan of salvation<sup>15</sup>), but both give the overriding structure within which individual experiences are processed and understood. Some models are better than others. Just as modern scientific models are much more developed, more sophisticated, and more consistent with much more finely observed data than were earlier world views, the Mormon plan of salvation is



*Orrery, Made by Newton and Company  
London, early 19th century*



also more specific, more informed, and makes more use of more detailed sources of revelation than were earlier religious views.

**5. Fundamental to Mormonism is the LDS experience with continuous revelation, and perhaps uniquely so.** We believe that God “will yet reveal many great and important things” (Articles of Faith 1:9). Science, likewise, is always in pursuit of further light and knowledge. If science had all the answers, it would largely be out of business. What would it still be looking for? By the same token, I suppose, any religion that *thinks* it has all the answers — as in a closed canon — probably *ought* to be out of business. Identifying problems in the old and bringing in solutions that are new are what scientific and religious revolutions are all about, but such changes come not without resistance.

Thomas Kuhn’s classic description of scientific revolutions has its parallels here: He speaks of normal science as puzzle-solving in the face of anomaly (Mormonism began when Joseph Smith sought to solve a puzzle littered with anomalies). Kuhn describes the crisis and resistance produced by the emergence of new scientific theories (compare the crises that arose as Joseph Smith advanced a whole new world view through the plan of salvation).<sup>16</sup> Kuhn articulates the ultimate resolution and success of scientific revolutions: “Probably the single most prevalent claim advanced by the proponents of a new paradigm is that they can solve the problems that have led the old one to a crisis.”<sup>17</sup> In the religious sphere, we have Joseph Smith solving the problems of how there can be a resurrection of the just and of the unjust or how it can be possible for all people to be exalted if baptism is the necessary gate through which all must enter. While these religious and scientific revolutions arise out of their separate domains, they have much in common structurally and functionally, and ultimately progress is made in both spheres through such revolutions.

**6. All this leads to an important need for humility.** Mormonism and science should share the willingness to admit tentativeness: to admit we do not know everything, to think of “dark matter” that tells us we may not know anything about 95% of the matter that fills the Universe, to speak of dimensions beyond our comprehension.<sup>18</sup>

In a compelling article on humility in science and philosophy, Duane Boyce gives an example of the overconfidence of Logical Positivism, headed by A.J. Ayer. In 1971, I experienced some of this overconfidence firsthand in one of Ayer’s seminars at Oxford: Chomping his big cigar, he snorted: “When we say, ‘Mary had a little lamb,’ how can we *know* that this doesn’t mean, ‘Mary ate a little mutton?’” His underlying point that day was: we do not and cannot know anything that we cannot verify empirically. But less than a decade later, as Boyce points out, A.J. Ayer had admitted, when asked about the main defects of the then nearly abandoned Logical Positivism: “The most important of the defects was that nearly all of it was false.”<sup>19</sup> It is best not to overstate one’s case and to advance one’s findings with appropriate qualifications.

But it is not only in science that things change. Religion and even our understanding of scripture have changed as new discoveries are made about the meaning of scriptural words and literary structures (in English, Greek, or Hebrew), about their manuscripts (both ancient papyri and the original manuscript of the Book of Mormon), about sacred texts from Qumran, or ancient Near Eastern texts from Babylonia or Ugarit, unfolding to view new understandings of ancient world views, typologies, covenant patterns, and prophetic speech forms. Some of these discoveries, like scientific discoveries, confirm and reinforce old understandings and beliefs; other discoveries send us back to rethink our religious emphases and awarenesses. As modern laws and social circumstances change regarding all sorts of things in people's daily lives, one must always be humble in the face of challenges that will be met, one way or another, by continuing research and revelations. Mormons who are conditioned by King Benjamin's plea are already comfortable with the need to "believe in God; believe that he is, and that he created all things, both in heaven and in earth; ... believe that man doth not comprehend all the things which the Lord can comprehend" (Mosiah 4:9).

### **Metaphysical Principles Shared by Science and Mormonism**

Moving on to the some of the metaphysical points ably discussed by Lester Allen,<sup>20</sup> we first note that science is driven to understand matter, while at the same time, matter also matters deeply to Mormonism. D&C 131:7–8 affirms, "There is no such thing as immaterial matter. all spirit is matter." This spirit-matter "more fine or pure," but it is still matter. D&C 93:33, "the elements are eternal."

As Parley P. Pratt emphasized, matter and spirit are of equal duration; both are self-existent. Matter as well as spirit is eternal, uncreated, self-existing. Thus, the *Encyclopedia of Mormonism* states: "In its unique LDS doctrine about matter, matter in all of its many forms, instead of occupying a subordinate role relative to philosophical paradigms, assumes a sovereign position, along with the principles and laws governing its properties and characteristics."<sup>21</sup> Whatever else this unique Mormon doctrine may imply, Mormonism and science both deeply value matter. Mormonism does not begin with the common assumption that has long prevailed and created problems in most corners of Christendom, namely that matter is undesirable, degenerate, temporary, bad, and even evil. If so, why would God (or we as resurrected beings) want to have — or even be able to have — a material body?

Mormon physical principles recognize that matter may appear in various states, some more refined than others, the same stuff but in two different states. Tracy Hall was famous for his accomplishment of making synthetic diamonds out of graphite. Graphite and diamonds, after all, are nothing but carbon in two different states.<sup>22</sup> I searched the Church's website to see if this very scientific detail had ever been used for spiritual instruction. I found that in the Primary 6 manual, Lesson 39, this scientific fact was used as an example to teach young children how the trials of Job could transform him from one kind of person into a person by living a higher law



*Graphite and Diamonds*

under extreme pressure.<sup>23</sup> Stephen Webb has noted that for Latter-day Saints, the distinction between natural and supernatural is “one of degree, not of kind.”<sup>24</sup>

Along with this shared view of matter, Mormonism and Science also share an appreciation for space and time. “Scripture speaks of the place where God dwells.”<sup>25</sup> For classical theology, of course, this is anathema. Yet Stephen Webb, in concert with Karl Barth’s theology of God’s space and its Christological form, puts God back into space, with its accompanying aspects of personhood, embodiment, relationality, and cosmology. Webb, by the way, states that “traditional and creedal theologians today have more to learn from Mormonism than any other religious tradition today, and that the Mormon position on matter can be reasonably defended.”<sup>26</sup>

Mormonism, like science, recognizes the reality of time. God exists in time, even if time is relatively different where he is. LDS scriptures speak of “the reckoning of the Lord’s time” (Abraham 3:9). Having God in time is an option not open to tradition Christian theologians, hence again creating another point of disconnect between science and religion in many minds.

As J. Ward Moody has concluded, from an LDS perspective, “The big bang may have marked a beginning of time for our universe and was likely a momentous event of eternal significance. But it was not the beginning of God nor of existence [or of time] itself.”<sup>27</sup>

The concept of the eternal nature of time, which accompanies the eternal nature of matter, serves LDS well in many ways.

Concerning mercy, for example, Alma 42:4 brilliantly resolves the otherwise stalemating conflict between justice and mercy by recognizing that because God too exists in time, mercy can operate fundamentally within temporal sequences and progressions. A just and righteous God could, and would, punish us instantly as soon

as one had sinned, but mercifully God has granted unto man time to repent, “yea, a probationary time, a time to repent and serve God,” and thus “God might be a perfect, just God, and a merciful God also” (Alma 42:15). It is in this postponement of the execution of a judgment that mercy is to be found. This concept of mercy is logically unavailable to traditional Christians who see God, essentially, outside of time.

And what about cosmology and cosmogony? Much has been said about the Mormon understanding of creation as a process of organization, not creation ex nihilo. Joseph Smith said, “create ... does not mean to create out of nothing; it means to organize; ... God had materials to organize the world out of chaos — chaotic matter, which is element.”<sup>28</sup>

And indeed, it has been recognized, not only by LDS scholars<sup>29</sup> but also recently by Christian and Jewish scholars<sup>30</sup> that the doctrine of ex nihilo creation was a relatively late development in Christian history, not present in the Bible. For example, Jon Levenson notes that we should best interpret Genesis 1:1 as a temporal clause: “When God began to create the heaven and the earth,” not suggesting an absolute beginning and that “formless and void” should best be translated as “primordial chaos.”<sup>31</sup> Open Evangelical theologians are even saying, that the “deep” in Genesis 1:2 “refers to something nondivine and primordially present when God began to create” and were “uncreated.”

Thus, whatever problems are created between science and religion over Genesis 1:1 may be due in large part to a problematic reading of Genesis 1:1 to begin with. Indeed, the understanding of the creation posited by advocates of open theology is also used to explain the continued existence of evil and the reality of Satan in the world, which has the advantage of breathing important life into the reality of the miracles performed by Jesus, many of which counteracted the natural presence of evil in the world. Seeing the natural history of this world as a kind of cosmic warfare, as Gregory Boyd has suggested, allows us to see the evolutionary



*The Divine Cosmographer*, 1640  
William Hodson, active 1625-1640



process “simply as the first stage of the battle we find being waged throughout human history,” namely “the battle that culminated in Christ’s life, death and resurrection.”<sup>32</sup>

Mormonism likewise affirms the reality of Satan and the forces of evil and therefore sees the creation process as a continuing event still going on today, not a single instantaneous event of the past. In this ongoing organization, Mormonism sees the uniting powers of God’s infinite (and therefore perpetual) at-one-ing [atoning] powers as staving off entropy (that would otherwise occur in a closed system), corruption, chaos, and disorder. God is still involved with this “earth” by lending us breath from day to day and supporting us “from one moment to another,” according to King Benjamin (Mosiah 2:21). Perhaps one will never be able to prove empirically that God is sustaining the world, but it is not unattractive to believe that something is holding this delicately balanced and orchestrated world together. Perhaps we do not see this simply because such things only “be discerned by purer eyes; [which] ... when our bodies are purified we shall see” (D&C 131:7-8).

Of course, science can describe what is happening in the world without necessarily making any reference to God, let alone making any claim to being able to give a complete description of all that is happening in the world, just as a docent in an art gallery can describe a painting without necessarily making any reference to the artist who painted it. You do not need God to do science, but think how much more you know about a painting by knowing about the artist and why he or she has painted it.

Mormonism and science both see the world as fundamentally pluralistic. As I and others have said, “LDS thought clearly emphasizes the importance of the fundamental plurality of the world.”<sup>33</sup> I think that Mormonism dynamically thrives over and over; the Mormon world view relishes multiplicity. Words found traditionally in only the singular are boldly spoken of as plurals in Mormon doctrine: We speak of priesthoods, intelligences, noble and great ones, two creations, worlds without number, continuing revelations, scriptures, covenants, degrees of glory, eternal lives, saviors on Mt. Zion, and even gods. Significantly, the universe even houses a manifold of laws! Joseph Smith spoke of many kingdoms and that “unto every kingdom is given [its own] law,” and “all truth is independent in that sphere in which God has placed it” (D&C 88:38, 93:30). To me, such statements of cosmological plurality unleash and transfigure the concepts of natural law. Traditional Christian theology, however, is essentially monistic, for everything was created by one God, in one stroke, and in one perfect state, a position one theological scholar, Clark Pinnock, has rejected as non-biblical,<sup>34</sup> principally in an effort to allow room for both the biblical and modern scientific views of things.

Mormonism sees great significance in the binary nature of the world. Light and dark, wet and dry, heaven and earth, hot and cold, plant and animal, animal and man, male and female, positive and negative ions, positive and negative magnetic poles, matter and antimatter, l-amino acids and d-amino acids,<sup>35</sup> active and passive,

and things to act and be acted upon. Things come in twos, even a double helix at the core of living cells. As Lehi famously said, “There needs must be an opposition in all things” (2 Nephi 2:11). Without opposition, choice would be illusory, purposeless, pointless, and impossible. The quite miraculously uniform fundamental moral and physical nature of this world is to be found in these opposites. For both Mormonism and science, this world is in tension, it is not static, it is not yet completed, but it is still unfolding, and “the unfinished and future-oriented aspect of things provides the basis for growth and improvement, even evolution.”<sup>36</sup>

Any discussion of creation and cosmology invites some comment about evolution, and it might be worth making yet again the point that it is just as important to read the scriptures carefully and correctly as it is to insist that science be done rigorously and cautiously. Many questions still remain on both sides. I was impressed by a point made by Duane Boyce that in Mormon 9:11, Moroni asks: “Who shall say that it was not a miracle that by his word the heaven and the earth should be; and by the power of his word man was created of the dust of the earth?” Boyce argues from this scripture that these two creative acts were performed as miracles (marvelous events) by God, and therefore there is scriptural support that they did not come about through undirected evolutionary processes governed by mere chance.<sup>37</sup> But what one might well ask is this: Does this leave room for the intervening events in the creative periods regarding plants and animals to have unfolded by some evolutionary process? It is important to note that scripture does not preclude such a possibility.

More could be said about Mormonism’s strongly preferring completeness over consistency as do modern science and math. For example, I am fascinated by the implications of Gödel’s 1931 incompleteness theorem, which demonstrates that a system can be either complete or consistent but not both.<sup>38</sup> Gödel’s work as a young mathematician at the University of Vienna successfully proved the “axiomatic” approach to mathematical thought as unsound. The original proofs of Gödel attacked the ancient Greek approach to mathematics, which accepts as true certain unproven axioms and



*Austrian Logician, Mathematician and Philosopher, Kurt  
Friedrich Gödel, 1906-1978*

derives from those axioms all other propositions as theorems.<sup>39</sup> This approach was successfully used in geometry and in Gödel's time was applied to other forms of mathematics. Gödel's proof, however, showed that approach to be unsound, and his theories have since been extended beyond mathematics to other disciplines, including philosophy and systematic theology. Thus, systematic theologies or rational philosophies may well be internally consistent but at the expense of completeness. Sets and abstractions may be helpful, but they are simply extractions of selected elements of otherwise messy realities. Mormon thought, in contrast, privileges fullness, abundance, completeness, and all that the Father has, even if that means Mormon life becomes joyously overloaded or torn by competing pressures that pull, stretch, and expand us in many ways. This may produce episodes of cognitive dissonance, social quandaries, mystery, and uncertainty, but if forced to choose, Mormon thought will always prefer openness over closedness, boldly inviting further growth, progression, and, fortunately for us in academia, further questions. For this reason, we choose to live with conflicts between religion and science rather than settle for half a loaf.

In contrast, "naturalistic determinists — like theological determinists — seek to have a completely contained universe. In this universe ... the cosmos unfolds with logical and ontological predictability."<sup>40</sup> But, as Craig Boyd argues, "The naturalistic determinism narrative ... is as much a myth as the Christian myth of the creation's original perfection." He cites the Heisenberg Uncertainty Principle and Gödel's Theorem as key reasons why "theists have strong reasons for believing that the universe is not a self-contained system."<sup>41</sup> Mormons couldn't agree more.

The standard objections to Aquinas' naturalism, Kant's idealism, or Hart's positivism is that they exclude too much of the picture of life, saying more and more about less and less, until they say virtually everything about nothing. Abstractions may be clean and clear, but they are also just that, extractions of selected parts from an unmanageable and perhaps naturally inconsistent whole. The answer is not to say less and less about more and more until one is left to say nothing about everything. Seeing reality as in many ways rationally unprovable may yield periods of unknowability, but here too Mormonism boldly recognizes that there must be an opposition in all things (see 2 Nephi 2:11), including rationality and irrationality, as paradoxical as that may seem.<sup>42</sup>

For this very reason, Joseph Smith objected to the limiting effects of denominational creeds, rational and consistent though they may be: "I want to come up into the presence of God, and learn all things: but the creeds set up stakes, and say, 'Hitherto shalt thou come, and no further.'"<sup>43</sup> In the LDS context, from the beginning, one even wants to keep all the commandments, even if some of those commandments appear to contradict others.

In other words, this world is messy. It is not perfect. It may be ordered in certain ways, but even within its order there remain important pockets of chaos and unpredictability.

Open Theologian Keith Ward speaks of the “huge ontological gap” that “exists between any and all models and the complex, fuzzy, dynamic and opaque real world.”<sup>44</sup> Thus, science and Mormonism, now joined by open theologians, acknowledge and even privilege complexity over simplicity. Occam’s Razor made sense in the medieval worldview, which viewed everything as quite simple, and therefore the simplest explanation was always to be deemed the best. But since the world is complicated, it will take something very complicated to begin to represent it adequately.

Among the most significant of points that could be underscored is our acceptance of a fundamental axiom that human nature is changeable, both for better or worse: “And again, verily I say unto you, that which is governed by law is also preserved by law and perfected and sanctified by the same. That which breaketh the law, and abideth not by law, but seeketh to become a law unto itself, and willeth to abide in sin, and altogether abideth in sin, cannot be sanctified by law, neither by mercy, justice, nor judgment” (D&C 88:34–35).

Other metaphysical and cosmological concepts could be similarly aligned, such as cause and effect, consequences, order, predictability, opposite and equal reactions, causation, determinism, and freedom. But I hope the points I have covered are sufficient as a starting point for further exploration.

In sum, Mormons do not approach the world as do dogmatic secularists, strict realists, or scientific determinists — all of whom make no room for God in this world. With them Mormons agree that laws are important and that regularity and order are necessary for choice. But laws cannot explain everything.

Neither do Mormons approach the world like the religionists, who as strict idealists, monists, and religious determinists or predestinationists, make or see no room for science in God’s world. With them we agree that God created the plan, has laid down the “determinate counsel” (Acts 2:23), and will honor every agreement he made. But under the plan adopted in that premortal determining council, God relates to other beings, animate and inanimate.

Mormons find some things in common with natural law theologians. Yet their proposed solution is that there is only one law, if we only knew it, while Mormonism sees one law in each kingdom: “All kingdoms have a law given; and there are many kingdoms, ... and unto every kingdom is given a law” (D&C 88:37–38).

### **Ideas Shared by Open Theology and Mormonism**

Mormonism might find a strong discussion partner in Openness theology. I have already mentioned the work of Keith Ward. I also recommend the two books edited by Thomas Oord, and William Hasker.<sup>45</sup> What do these Open Theologians believe, and why should their efforts be of interest to LDS?

- They say: There were divine or preexisting things that God did *not* create: We likewise say God organized co-existing matter.



*Artwork Depicting Star Formation*

- They do not find any place in the Bible that says God created *everything*. In fact, they find in Genesis 1:2, the presence of matter unorganized, without form, which the Hebrew can be translated to read “chaos.” There was chaos. There is the deep, also, which is not a part of the dry land and the world which is created by God, according to their reading of Genesis 1 and indeed according to Joseph Smith’s reading.
- They say: Humans are genuinely free to make choices [not predestined]: We agree.
- They say: God experiences others in some way analogous to how we experience each other: i.e. that we are in some ways like him, and he is in important ways like us.
- They see God as changeable: our prayers can change his mind.
- They see God as relational, completely committed to helping his children in the best possible ways. So do we: “For this is my work and my glory” (Moses 1:39).
- They say: God takes calculated risks because God is not all-controlling. He even shares with other beings the ongoing process of creation. We agree that God is willing to allow us to fail, although it gives him great sorrow.
- They say: God’s *experience* changes, yet his nature or essence is unchanging. We agree that God is still in some sense progressing.

- They say: we do not know everything and that the future is still, in important senses open, not predestined.<sup>46</sup> We couldn't agree more. Now, they do not think of an open canon — they do not go quite that far. But the idea of open revelation can't be far away from their basic approach to theology.

Notice how far these open theologians have departed from traditional Christian theology and how they have taken positions based on their reading of the Bible alone that are close to LDS understandings. More than that, notice how their theology changes the fundamentals of the debates over the existence of Satan and evil and chaos in this world, even today, as the conflict with evil is still ongoing. It changes the debates over the Heisenberg Uncertainty Principle and its implications for opening up our understanding of divine foreknowledge, or naturalistic determinism, and human free will, or for God's drawing (and I quote from them): "humans and other personal agents into the process of world-making."<sup>47</sup>

I do not mention this new development because I think open theologians have it all figured out but rather to illustrate an important point: that not all theologies are created equal. Some are more "science friendly" than others. In other words, some theologies have what I would call a higher "Sci-Q" or "science quotient" than others. I find that the open theology and Latter-day Saint doctrines both have very high Sci-Qs, making potentially strong discussion partners as well as potential allies with much of science.



### **Toward a Friendly Alliance Between Science and Religion**

Finally, I wish to say a little about how these alignments might serve as lynchpins in forging a friendly alliance between science and religion. In this world we need all the friends we can get. Alliances are desirable if carefully negotiated. Religion and science can learn much from the worlds of law, alternative dispute resolution, and international treaty formation. As Mormon statesman J. Reuben Clark said, one must avoid the hazards of alliances being used inappropriately, especially if it

might require a party to behave in a manner that contradicts its basic standards and beliefs.<sup>48</sup>

Overall, forming alliances, partnerships, and marriages is generally a very good thing. As Steven R. Covey says, “In every conflict of two opposing alternatives, there is always a third.” He calls that third alternative, synergy. “Synergy is what happens when the whole is greater than the sums of the parts.”<sup>49</sup> “In a compromise,  $1 + 1 = 1\frac{1}{2}$ . In other words, everybody loses something. Both sides make concessions, neither side is truly satisfied, and the conflict is just postponed.” When you get to synergy, however, energy is created rather than lost. In this case,  $1 + 1 = 2\frac{1}{2}$ . The first step in getting to synergy is the willingness “to put aside your position long enough to understand the other side”<sup>50</sup> and to realize that the more you differ, the more both sides can learn from the other’s perspective.

In the quest for truth in the best of all worlds, as Robert L. Millet has sensitively written from the voice of deep, genuine experience, “If my Latter-day Saint colleagues and I can enjoy such a sweet brotherhood and sisterhood with a growing number of Evangelical Christians, ... then surely it is possible for men and women of faith who labor in varying avenues of science to enjoy cordial and collegial relationships with those involved in the study and teaching of religion.”<sup>51</sup> He goes on: “Our epistemological thrusts may be different. Our predispositions may be different. Our tests of validity and reliability may be different, but our hearts can be united as we strive to look beyond the dimensions of our disciplines towards higher goals.”<sup>52</sup>

Against the strong currents of moment, BYU and Latter-day Saints have many opportunities to contribute to this alliance, precisely because they care so deeply about both. In building bridges, in any kind of alliance or partnership, it is important to emphasize and build upon similarities and commonalities rather than to focus too rigidly or exclusively on the differences.

Forming alliances can be tricky and risky. In some periods of American history, politicians have shunned any forms of treaties, viewing all of them to be entangling alliances, and for this reason people rightly think long and hard before entering into any treaty, alliance, or partnership, internationally or legally, as J. Reuben Clark rightly and frequently cautioned. For example, he opposed any alliance that sought to accomplish big power domination of small states.<sup>53</sup> There have been times when treaties and alliances were not very useful to various countries, but from times as early as the ancient Near East, empires were built and operated on the basis of treaties and covenants that were not only useful but in many cases necessary.<sup>54</sup> Nations far apart from each other with little or no interaction with each other may not need a treaty, but countries or academic institutions sharing long and disputed borders have little choice but to enter into some kind of carefully constructed and operated treaty for their mutual benefit and not the dominance of either one over the other.

A research group in the United Kingdom, Alliance Best Practice (ABP), helps its clients generate more value from their strategic alliance relationships through the discovery, dissemination, and delivery of their “best practices” guidelines. The organization offers a database of over 130,000 observations of “alliance best practices in action” generated from examining in depth over 300 companies. In a set of 52 guidelines, ABP asks its clients such things as whether or not they have identified the business value of the relationship, have conducted due diligence before entering an alliance, have spelled out an optimum structure for the relationship, and have articulated common and for the relationship.<sup>55</sup> I am not suggesting this exact kind of strategic alliance procedure, which works in an international setting, could be naively transferred over and used automatically in handling relations between religion and science, but it does seem to me that building a strong and successful alliance between scientists and religionists won’t happen if the parties simply hope a good alliance will emerge *ex nihilo* or somehow in a big bang. Good relationships require conscious formation and deliberate development.

How might an alliance between science and religion then be negotiated and structured? First, nations most often commit themselves to fight alongside each other because of shared values and ideals. Having a common enemy or common objectives is essential to any alliance. Even though science and religion may agree on some important issues, many pressing current issues could be identified to bring them into closer cooperation. Even though the British and the Americans once fought each other, and even though the French and the Americans speak different languages and have different legal systems, current issues regarding international security and world trade bring these allies tightly together. Is it too much to imagine science and religion finding ways to make progress together regarding global warming and environmental issues that affect future generations, in better understanding issues of understanding human life, the correction of criminal behavior, and resolving health care debates that leave everyone in today’s world baffled? What about the need just for greater appreciation and amazement concerning the world around us, to overcome boredom, and to increase the enjoyment of the world around us?

In addition to having a common ideal or objective, allies need to realistically offer benefits to each other, especially benefits or abilities that the other partner lacks. Here also, it seems to me that there are important ways in which science and religion do fundamentally different things, both of which are crucially needed for the other. In particular, science is much more interested in and in many ways limited to making observations of past events, whether tests run in the laboratory a few hours ago or geological fossils deposited eons ago. Religion, on the other hand is more concerned about the future, what will happen in the world to come, and how should people live today to create a more righteous and attractive world? Science is descriptive, whereas religion is prescriptive. Science is more interested in mechanisms (when, where, and what has happened), whereas religion is more interested with relationships (who has been involved, how, and why). Science is typically quantitative, and religion qualitative. Philosophy has argued persuasively



that it is impossible to derive an *ought* from an *is*.<sup>56</sup> No matter how much a person knows, that knowledge does not create a moral obligation. People may know that smoking causes lung cancer, but that fact does not create a moral obligation not to smoke. Science can tell people how to do something and why a mechanism works, but religion gives people guidance and spiritual access to authoritative revelation, personal inspiration, and prayer to determine what one should do, including the manner and purpose for which it should be done. The more that science and religion recognize the strengths the other can bring to the table, the more likely they will be to form friendly and constructive alliances.

LDS scientist Richard Haglund has written about the common interests of science and religion in preserving moral and intellectual freedom, necessary for both for the scientific and religion communities, and about “the need of science for periodic infusions of categories and concepts not available in its own storehouse — a need which has frequently been met by theological, religious or mystical perceptions of the universe.”<sup>57</sup> Science also “offer[s] to religion a valuable example of the continual interplay of creative doubt with an abiding faith in the basic orderliness of the universe.” What so cripples science, Haglund continues, is its tendency towards idolatry — that is, towards the treatment of some sort of collective set of representations as if it were itself the sub-sensible basis of the phenomenal world. Religion can be of use in curing

this problem. What cripples religion is pride. Science, with its constant reminder of the limits of our knowledge, can help cure pride.<sup>58</sup>



And in other ways, Henry Eyring speaks of many things with which science enhances religion. For example, helping to “sift the grain of truth from the chaff of imagined fable” and by quantum mechanics countering mechanical determinism.<sup>59</sup>

In any event, we cannot count all the ways in which religion and science may help each other. This remains to be explored. “But it must be based on a steadfast refusal to gloss the apparently inevitable points of difference between disciplines, and a determination to treat conflicts as opportunities for a union in diversity, rather than as challenges to do battle over contested territory of thought.”<sup>60</sup>

And finally, it is important to think how good allies treat each other, much as how loving spouses treat each other. According to the best alliance findings:

- Good allies make allowance for differences.
- They think more often about “us” and less often about “me.”

- They think about doing things together with an inclusive “both” and an “and” rather than an “either/or.”
- Good allies have an absolute commitment to their ideals, and yet they realize their relationship is a work in progress and serves to meet new challenges as they may arise.
- Good allies are not dogmatic or intransigent but wish to gather knowledge and humbly listen to the needs of the other. Respect and tolerance are crucial, even though these virtues have not characterized most struggles between scientists and religionists since the beginning of modernity.
- One ally does not diminish the other. Much has been said about science as the weaker ally and the spirit, the better. While that may be true enough, let the head not say to the foot, I have little need of you. Let the stronger ally never say to the weaker, you are less important at what you do. What’s to be gained by that? As B.H. Roberts said, both may be of first-rate importance.<sup>61</sup>
- Good allies do not intentionally harm one another but rather look out for each other’s interests and help each other by supplying information and giving constructive criticisms to each other.
- They ask each other helpful questions and press the other to address hard issues. For example, might not either side ask:

Did the Nephites really know about the rotation of the earth around the sun? David Grandy has recently analyzed Helaman 12:15 as saying something different.<sup>62</sup>

Have scientific researchers reported their findings completely and accurately?

Have creationists failed to consider what the word *state* might mean in 2 Nephi 2:22, and might it mean that Adam and Eve would have simply remained in the “state of innocence,” as their state is called a verse later, and what might Lehi have meant by that? These are helpful questions that may encourage working partners to look harder at things both sides may have taken for granted, things they have overlooked, to assumptions that may not be working so well.

- With full information, friendly allies allow each other the latitude of making independent decisions, and they give each other the benefit of the doubt if arguments arise or if decisions are made that seem to go against the interests of the alliance.
- If a decision by one ally turns out to be wrong, especially if it causes harm to the other, allies fix their mistakes and try to compensate for the

harm done to the consortium. Competence, after all, is what you do after a mistake.

Obviously the political machinery for proposing and negotiating alliances does not exist in the world of science and religion, but this does not mean channels of communication cannot be opened in this regard. *Zygon, Journal of Science and Religion*<sup>63</sup> is a good example. Professional associations such as the American Academy of Religion and other such organizations must have sections that coordinate and sponsor academic conferences and publications on science and religion questions.

I believe that whatever the historical causes of war between science and religion, whatever the mythological or ideological decision of history in this regard that may have occurred,<sup>64</sup> we should advocate peace between science and religion. We should be peacemakers. Meaningful accommodations have already successfully been made. Significant progress has been accomplished in recent decades. Noticing the positives will allow us to bury old hatchets and get to “yes” rather than “no.” We have all come a long way since the Inquisition, and science has no need to fear any longer for its continued existence and vitality. One might even argue that science is more likely to find greater acceptance and that scientists will find more willing populations to apply their results if they have respectfully thought through and ameliorated ways in which their work may negatively impact religious predilections and sincerely held values.

I am not sure who is behind perpetuating this conflict any longer, what their objectives and interests might be, but I cannot image this war must or should go on indefinitely, any more than any other war. One hopes the old days of imperialism are gone, and one can also hope the competition for dominance between science and religion will also be felt to be incompatible with a world that values open discussion, the market place of ideas, and especially the promotion of the best in all things. Although in this marketplace one must also guard against the democratic evils of the tyranny of any majority and be aware of the fact that sometimes the best ideas do not survive simply because they get shouted down or do not happen to be articulated or communicated as widely as their competition. But in any event, the objective of any protracted war between science and religion certainly should not be obliteration or annihilation of the opposing party. Neither should the objective be the construction of a Berlin Wall, let alone a Maginot Line<sup>65</sup> between the two. Science and religion were once married, and that marriage has run into troubled times. But just because an alliance or a marriage runs into disagreements doesn't mean that we must or should call the whole thing off and descend into all-out hostility, separation, and costly divorce.

### Promising Years Ahead

In conclusion, there is still much work to do, but I see very promising years ahead. Mormon metaphysics and LDS religious fullness seem to me to offer new ways of thinking about traditional problems in the science and religion debate. The Mormon

way of thinking may raise unique issues of its own, but they are not the traditional problems that have stood behind the science and religion stalemates. We can move beyond those blockades. There will always be worldly things that will make it difficult to be a Latter-day Saint by making some Mormon beliefs objectionable, frustrating, or awkward. We won't always have all the answers to all these difficulties, certainly not the moment they first arise. But our ongoing task as Latter-day Saints is to build bridges and to lay ourselves down as a bridge over troubled waters, even if that means we get shot at from people on both ends of the bridge. Our mandate is to embrace these challenges constructively and to develop objective defensible answers that are also consistent with our scriptures, doctrines, and spiritual knowledge.

Just as Latter-day Saints are likely to see *work* differently from the world — because we know that God himself has a work, and it is his glory, and that faith without works is dead (Moses 1:39; James 2:26); and just as we see *ethics* quite differently — because, for us, humans are not disconnected creatures with whom we selectively enter into social contracts, but all are related to us as members of our premortal family; and just as we see *power* differently — because we take seriously the scriptural curse placed on anyone who misuses power for glory or gain, and we know that the greatest must be the servants of all (see D&C 121:36–39; Matthew 23:11), so we are bound and blessed to see science differently, because we come at our science and at our religion equipped with a difference set of assumptions about fundamental, metaphysical axioms. At Brigham Young University we have the constant opportunity to bring these Mormon insights to bear on all kinds of scholarly and scientific topics and at the same time to bring scholarly and scientific perspectives to bear on religious and spiritual topics of importance to Latter-day Saints. If we think there isn't a Mormon point of view on any subject, it may well be that we haven't yet looked and stretched high or deep or wide enough.<sup>66</sup> To this end, there is much work yet to be done in forging and strengthening the strong, productive, and friendly LDS alliance between science and religion.

We need to keep up with new developments both in science and in religious discussions. Blithely regurgitating conclusive statements that were popular forty or eighty years ago is annoying, to say the least. As Henry Eyring has said, “We run grave risks ... if we teach our pupils some outmoded and nonessential notions. ... Do not defend a good cause with bad arguments.”<sup>67</sup> Dallin H. Oaks reinforces this statement: “A bad argument is worse than no argument at all.”<sup>68</sup> Imprecise statements about “true science” and “true religion” need to be avoided, as we strive to make ourselves better understood, especially in our classes and among our academic peers.

It is a joy to be at BYU at this moment in the intellectual history of the Latter-day Saints as a people. I am deeply grateful for the unabashed amazement that my BYU professors in the 1960s exuded as they taught me the wonders of biospheres and ecosystems and the sophisticated elegance of mathematical proofs. After all that can and has been said, I find science to be a work of art and beauty. I like it when we think about the creation of this world and pronounce it not just “good,” but “beautiful” (*kala*, LXX Genesis 1:31).



Left: *Ezra Taft Benson Building, home of the BYU Department of Chemistry and Biochemistry;*  
Right: *Joseph Smith Building, home of the BYU College of Religious Education*

I really believe in the fullness of the gospel and the openness of science and knowledge. I have tried to embrace all truth in one great whole and go in as many constructive directions as I can.

Our eternal purposes all lead us to Christ. He is the only truth (John 14:6) who will make us free (John 8:32), even if we can only approach him as a limit. I testify that he lives; he who marked the path and shows the way of life and that “the preeminent manifestation of the eternal nature of both physical and spiritual matter is found in the eternal existence of God and ultimately his human children as discrete, indestructible entities.”<sup>69</sup>

*An earlier version of this chapter was presented as the Summerhays Lecture, College of Physical and Mathematical Sciences, BYU September 22, 2011.*

### Endnotes

1. See my chapter on “The Role of Evidence in the Nurturing of Faith” in Donald W. Parry, Daniel C. Peterson, and John W. Welch, eds., *Echoes and Evidences of the Book of Mormon* (Provo, UT: FARMS, 2002).

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3. For example, my work on chiasmus in *Chiasmus in Antiquity* (Hildesheim, Germany: Gerstenberg, 1981).
4. J. W. Welch, "Counting to Ten" *Journal of Book of Mormon Studies* 12/2 (2003): 42–57.
5. Hugh W. Nibley, *One Eternal Round*, CWHN 19 (Salt Lake City: Deseret Book and FARMS, 2010).
6. Works on science and Mormonism include: *Converging Paths to Truth: The Summerhays Lectures on Science and Religion*, Michael D. Rhodes and J. Ward Moody, eds. (Provo, UT: Religious Studies Center and Deseret Book, 2011); Jae R. Ballif, *In Search of Truth and Love* (Salt Lake City: Bookcraft, 1986); Alvin K. Benson, "Some Key Ingredients for Finding and Understanding the Truth in Science and Religion," in *Second Nephi: The Doctrinal Structure* (Provo, UT: Religious Studies Center, 1989), 341–53; Duane Boyce, "Of Science, Scripture, and Surprise," *FARMS Review* 20:2 (2008); Melvin A. and Melvin G. Cook, *Science and Mormonism* (Salt Lake City: Deseret Book, 1973); Henry J. Eyring, *Mormon Scientist: The Life and Faith of Henry Eyring* (Salt Lake City: Deseret Book, 2007); *Reflections of a Scientist* (Salt Lake City: Deseret Book, 1983); and *The Faith of a Scientist* (Salt Lake City: Bookcraft, 1967); David Grandy, "Ideology in the Guise of Science," *FARMS Review* 19 no. 2 (2007); Paul R. Green, comp., *Science and Your Faith in God* (Salt Lake City, 1958), 23–40; Wilford M. Hess and others, eds. *Science and Religion: Toward a More Useful Dialogue* (Geneva, IL.: Paladin, 1979), reviewed by William Evenson in *BYU Studies*, 20:1 (1980); Hollis R. Johnson, "The Big Bang: What Does It Mean for Us?" *FARMS Review* 16 no. 2 (2004); Blake T. Ostler, "Out of Nothing: A History of Creation ex Nihilo in Early Christian Thought," *FARMS Review* (17 no. 2 (2005), 253–320; Erich Robert Paul, *Science, Religion, and Mormon Cosmology* (Urbana: University of Illinois Press, 1992), reviewed by Richard Haglund in *BYU Studies*, 33 no. 1 (1993); Daniel C. Peterson, "Of 'Galileo Events,' Hype, and Suppression: Or, Abusing Science and its History," *FARMS Review* 15 no. 2 (2003); John W. Welch, "The Power of Evidence in the Nurturing of Faith," in *Echoes and Evidences*. Donald W. Parry and others, eds. (Provo, UT: FARMS, 2002) and "Thy Mind, O Man, Must Stretch," *BYU Studies* 50:3 (2011); John A. Widtsoe, *Joseph Smith as Scientist* (1920); *A Rational Theology* (1926); and *In Search of Truth: Comments on the Gospel and Modern Thought* (1930); along with a number of articles on science and religion in *BYU Studies*.

7. I have drawn the quotations below from Rodney Brown, "In Your Mind and in Your Heart," in Michael D. Rhodes and J. Ward Moody, eds, *Converging Paths to Truths: The Summerhays Lectures on Science and Religion* (Provo, UT: RSC and Deseret Book, 2011) at <http://rsc.byu.edu/archived/converging-paths-truth/your-mind-and-your-heart>.
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9. *Discourses of Brigham Young*, ed. John A. Widtsoe (Salt Lake City: Deseret Book, 1977), 382. John Taylor, in *Journal of Discourses* 16:369. For a balanced, scholarly discussion of the history and meanings of the idea that Jesus Christ is a brother to all mankind, who all with him have God as their Father (Matthew 6:9; 7:21), see Corbin Volluz, "Jesus Christ as Elder Brother," *BYU Studies* 45 no. 2 (2006): 141–58.
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12. Dennis Rasmussen, s.v. "Metphysics," *Encyclopedia of Mormonism*, 895. Online at <http://eom.byu.edu>.
13. <http://rsc.byu.edu/archived/converging-paths-truth/your-mind-and-your-heart>.
14. <https://history.lds.org/article/historic-sites-ohio-kirtland-temple-kirtland?lang=eng>.
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# SCIENCE AND MORMONISM

Henry Eyring

When one of my grandsons was a small boy, just starting Primary, someone remarked to him, “So now you are a Sunbeam.” His face clouded, and he answered, “I am not an ‘unbeam, I’m Henry Johnson Eyring!” I can understand how we sometimes object to being labeled. Some labels we accept. For instance, I’m content with “Mormon,” “devout,” “Christian,” “chemist,” “husband,” “father,” and so forth. Sometimes, however, a label is loaded with emotional baggage far beyond its usefulness and importance. For example, “organic evolutionist” or “creationist” are labels, either one of which I would reject for myself, at least. They simply carry too much baggage and confusion for my taste.

Considering the difference in training of the members of the Church, I never cease to marvel at the degree of agreement among believing Latter-day Saints. However, organic evolution is one topic upon which there is apt to be wide disagreement.

Such a topic becomes controversial partly because it is interesting to us, but it seems to be sufficiently nonessential to our salvation that the Creator has only briefly treated it in the scriptures. If you think about it, it makes almost no difference at all to the way we should live our lives and treat one another. Still, there are those who line up on both sides as if everything depended on the outcome of this year’s “monkey trial.”

Some people object to the slightest hint of being related to the rest of the animal kingdom, particularly the hairy apes. The idea is right next to the three “S’s” — spiders, snakes, and sharks — on their list of things beyond the pale. I’ve never had that aversion. In fact, I’ve kind of enjoyed what little I’ve seen of them.

One time I was stuck most of a day in London and couldn’t face the thought of sightseeing, so I went to the London Zoo. I was attracted by a crowd watching the great apes. One fellow in particular was getting a lot of attention as he sat close to the front of the cage on a tree platform. As the zoo visitors moved closer, he suddenly



spewed them with water that he had in his mouth. Now, that was interesting! I found a bench across the path — out of range — and watched. The ape got down and went over to his water trough to reload. He then went about the cage awhile and finally repositioned himself on the platform. He waited — patiently. Finally a new group of humanoids, not aware of the danger, moved into range. Spray! Splat! Bullseye! The fellow practically chortled out loud as he made his trip to the trough. I spent the entire afternoon enjoying his enjoyment. Theoretically, he was there for our amusement, but quite clearly, he didn't understand that. He thought we were there for him. I have to admit I kind of admired the fellow. Animals seem pretty wonderful to me. I'd be content to discover that I share a common heritage with them, so long as God is at the controls.

I have always felt comfortable with the views of our trained scientists among the General Authorities. For example, James E. Talmage delivered a sermon entitled "The Earth and Man" from the Salt Lake Tabernacle on August 9, 1931, and John A. Widtsoe published "Science and the Gospel" in the Young Men's Mutual Improvement Association manual of 1989. Each of these brethren regarded the earth as having a very great age and were open to the testimony of science to uncover the truth of those questions.

What, then, is to prevent us from seeking to understand God's methods of creation by any and all means available to us? Many avoid seeking understanding from science because they believe that any theory in conflict with the Lord's revelations will finally be proven false. Of course, given those assumptions, the position is clearly correct, since I don't believe that God intentionally misleads his children.

We have a dilemma, however, because God has left messages all over the physical world that scientists have learned to read. These messages are quite clear, well understood, and accepted in science. That is, the theories that the earth is four-and-one-half billion years old and that life evolved over the last billion years or so are as well established scientifically as many theories ever are. So, if the word of God found in the scriptures and the word of God found in the rocks are contradictory, must we choose between them, or is there some way they can be reconciled?

The scriptures state that Adam was the first man on the earth and that he was also the first flesh. Other scriptures teach that Adam was not subject to mortal and spiritual death before the fall and that the fall brought these deaths into the world. Also, the scriptures say the earth is passing through seven periods ("days") of temporal existence and that it was not temporal before the fall. Each of these ideas seems to be in conflict with the scientific views of organic evolution, but are they?

The fundamental principle that has guided my religious life is that I need believe only what is true. The gospel is the truth as learned or discovered by whatever means and tools I can lay my hand or mind on. I appreciate the scriptures for their insights into how to love God and my neighbor and how to learn obedience to the laws and ordinances of the gospel. These teachings are precious to all devoted Latter-day Saints. However, the brevity of the scriptures about God's methods of creation indicate that this may be a subject we will understand sometime but do not need to worry about for the time being. "Yea, verily I say unto you, in that day when the Lord shall come, he shall reveal all things — things which have passed, and hidden things which no man knew, things of the earth, by which it was made, and the purpose and the end thereof — things most precious, things that are above, and things that are beneath, things that are in the earth, and upon the earth, and in heaven." (D&C 101:32–34.)

In the meantime, I think it is perfectly appropriate for us to study and learn as much as we can about this wonderful place God has prepared for us.

We should keep in mind that scientists are as diligent and truthful as anyone else. Organic evolution is the honest result of capable trying to explain the evidence to the best of their ability. From my limited study of the subject I would say that the physical evidence supporting the theory is considerable from a scientific viewpoint.

In my opinion it would be a very sad mistake if a parent or teacher were to belittle scientists as being wicked charlatans or else fools having been duped by half-baked ideas that gloss over inconsistencies. That isn't an accurate assessment of the situation, and our children or students will be able to see that when they begin their scientific studies.

"Now wait a minute," you say. "I thought you weren't an 'evolutionist'!" I'm not. I'd be just as content to find out that God stirred up some dirt and water, and out stepped Adam, ready to occupy the Garden or Eden. The only important thing is that God did it. I might say in that regard that in my mind the theory of evolution



*The Creation and the Marriage of Adam and Eve*, ca. 1470-1475. Illustration from Flavius Josephus, *Les Antiquités judaïques*, illustrated by Jean Fouquet (ca. 1420-ca. 1480) and studio

has to include a notion that the dice have been loaded from the beginning in favor of more complex life forms. That is, without intelligent design of natural laws in such a way as to favor evolution from lower forms to higher forms of life, I don't think the theory holds water. I can't see randomly generated natural laws producing these remarkable results. So, in my mind, God is behind it all whether we evolved or not.

Probably one of the most difficult problems in reading the scriptures is to decide what is to be taken literally and what is figurative. In this connection, it seems to me that the Creator must operate with facts and with an understanding that goes entirely outside our understanding and our experience. Because of this, when someone builds up a system of logic, however careful and

painstaking, that gives a positive answer to this difficult question, I can't help but wonder about it, particularly if it seems to run counter to the Creator's revelations written in the physical world. At least I would like to move slowly in such matters.

The really awful thing about me is that I really don't care one way or the other. Sometime, a billion years from now, it may come up in some heavenly science class and I'll be glad to know, but until then I'll be content.

God likes me and won't give up on me no matter what. He'll keep encouraging and praising me when he can, chastising me when he must, but will never stop hoping that I'll make something out of myself. He is so much more advanced than I am, he couldn't be very impressed with my wisdom; it's my effort that really counts. I'm not apt to teach him anything he hasn't already known for a long time. One of the nicest things is his tolerance of us.

Once when I was speaking at the University of Utah as part of a panel on man in the cosmos, I built my talk around the famous question of Pontius Pilate, "What is truth?" After my talk, a young man in the audience stood up and said, "Well, Dr. Eyring, they tell me that what you do is put science in one compartment and your religion in another. Isn't that inconvenient? In the *Young Women's Journal*, Joseph Smith is reported to have said that people are living on the moon." He continued, "Now, Dr. Eyring, we know there is no oxygen on the moon, so that couldn't possibly be true. What do you say to this question?"



I answered about as follows:

I especially appreciate being asked that question because it is easy to answer, and I like easy questions better than hard ones. As a Latter-day Saint, like any other honest man, I am obliged to accept only the truth. I simply have to investigate whether men live on the moon. I am reasonably certain they don't, but we'll soon know by direct exploration. If we don't find them there, they don't live there. As a Latter-day Saint, my problem is as simple as that.

Many times men of importance have statements attributed to them they never made. I think that if J. Golden Kimball said all the things he is credited with saying, he would have had to talk even more than he did, and he did very well.

Now what about the Prophet Joseph Smith? I don't know whether or not he said men live on the moon. But whether he did or not troubles me not in the least. A prophet is wonderful because he sometimes speaks for the Lord. This occurs on certain occasions when the Lord wills it. On other occasions, he speaks for himself, and one of the wonderful doctrines of this Church is that we don't believe in the infallibility of any mortal. If in his speculations the Prophet thought there were people on the moon, this has no effect on my belief that on other occasions, when the Lord willed it, he spoke the ideas that the Lord inspired him to say. It is for these moments of penetrating insight that I honor and follow him.

There is a further point that needs emphasis. The gospel is not the people in the Church. The gospel is not even the people who direct it. *The gospel is the truth.* One will have difficulty finding better men than we have presiding over the Church at present and than we have had in times past. Still, they are human beings, as we are.

Some people have pointed to some member of the Church and said, "Now, Dr. Eyring, that's one of your brethren, and he's not what he ought to be." My answer is this: "Well, you ought to see what he'd be like if it weren't for the Church." We have to keep firmly in mind at all times the two aspects of the Church: its divinely inspired perfect side and the human side.

Perhaps I can say it another way. This Church would have been perfect if the Lord had not let people into it. That is where the mistake seems to have been made, but we understand this, too. The Church is part of the Lord's wonderful plan to work with you and me. Mankind is thus singled out because of man's divine origin and transcendent destiny.

I would leave the Church and abandon its teachings if I could figure out some way to do so honorably and consistent with my desire to know the truth, no matter what the source. I find myself unable to build out of my experience an acceptable case for disbelief. In fact, the case favors belief. It goes something like this:

1. The physical universe exhibits striking characteristics: the complexity of the nucleus, the exactness of the atom, the unity of life, the predictability of the everyday world, and the enormity and longevity of space.

2. Not only is the universe complex, exact, orderly, and predictable, but it is also running down. The second law of thermodynamics indicates that since a closed system can only run down and can never get wound up in the first place, either there are some exceptions to these natural laws we don't know about or the physical universe is not a closed system. That is, there is something or someplace outside the physical world from which energy was obtained to fire "the big bang."
3. The combination of intelligence and power that assembled the materials and energy, set off "the big bang," and provided order, complexity, exactness, and precision in the physical universe is called the Creator, the Supreme Being, God, and so on.
4. As scientists believe that nature is not capricious, and therefore we can expect things we can't measure to behave in ways similar to things we can, it is reasonable to assume that the Creator's world is also a place of order, complexity, exactness, and precision. This is an example of the importance of postulates in science and religion. In order to seek to learn truths about the physical world we must assume some things we can't prove. (An example is uniformitarianism — the proposition that the rules as we now observe them were the same in the past and will be in the future and that therefore we can understand the past and predict the future based on what we observe now.) Similarly, in order to seek for truth in spiritual things, we must adopt some basic assumptions or postulates that also can't be proved.
5. Basic spiritual assumptions or postulates might include: (a) God exists, (b) God has curiosity and interest in what he has created, (c) God knows me, (d) God is at least as compassionate and just as the good people I know.
6. The truth of these postulates is determined by seeing if the results of "experiments" can be best predicted by their adoption. That is, as we experience life, study history, and seek communion with God, is what we find best explained by acceptance of our postulates?
7. God is tolerant of our efforts. He's willing to have truth discovered "line upon line, precept upon precept." That is, he doesn't mind that we don't yet know everything about science or religion.
8. The gospel is the truth. All truth is part of the gospel, regardless of how the truth has been learned.
9. The safest course is to work like the dickens and do even more than is required to be done. That's the way I get the most freedom to maneuver.
10. Most important, the foregoing nine points don't answer all the ques-



tions. If I take everything I know from the scriptures and the prophets and everything I know from science and reconcile them, I still have as many unanswered questions as I have ones with answers. No intellectual approach nails down everything. In this life there will always be unanswered questions. In fact, each answer seems to raise more questions. That's the way it is in science, too, and I don't apostatize from science for that reason. Actually, that's what makes science and religion fun. Faith is feeling along after truth as best I can.

11. Finally, perhaps a believer never does more disservice to religion than to support the truth with bad arguments. The listener spots the obvious errors, becomes impatient, often "throws out the baby with the bath," and turns away, even from true religion.

As parents and teachers, we pass on to our children and pupils our world picture. Part of this picture is religious, and part of it deals with the world around us. If we teach our pupils some outmoded and nonessential notions that fail to hold water when the students get into their science classes at the university, we run grave risks. When our protégés shed the bad science, they may also throw out some true religion. The solution is to avoid telling them the world is flat too long after it has been proved round. Don't defend a good cause with bad arguments.

So, I am certain that the gospel as taught in The Church of Jesus Christ of Latter-day Saints is true. It's a better explanation of what I observe in science than any other I know about. There are still lots of things I don't know, but that doesn't bother me. I'm a happy muddler. The gospel simply asks me to find out what's true as best I can and in the meantime to live a good life. That strikes as the best formula for living there could be.



# ANSWERING NEW ATHEISM AND SEEKING A SURE KNOWLEDGE OF GOD

Amy L. Williams

Through the ages, men and women have sought answers about the meaning of life, expending great effort to understand the nature of their existence and to worship their own concept of divinity. At the same time many have wondered which concept of God is correct and, moreover, whether divine beings exist at all. The debate over the existence of God has been ongoing for centuries and took on new life when modern science began to offer materialistic explanations for the formation of life and other natural phenomena. Using scientific discoveries and philosophical arguments, prominent naturalists and philosophers have argued both for and against the existence of God, and the debate continues today.

Atheism, or a lack of belief in God, has existed for centuries, but a more recent atheist movement, termed *New Atheism*, has become influential in this discussion. Over the past decade, New Atheist scholars and public figures have published widely read books,<sup>1</sup> organized large public rallies,<sup>2</sup> and written articles in the popular press<sup>3</sup> that have been harshly critical of religion and belief in God. The New Atheist messages often carry an impassioned tone and have the zealous aim of converting individuals away from belief in God.

The *Internet Encyclopedia of Philosophy* entry for “New Atheists” describes adherents to this movement as follows:

The “New Atheist” label for these critics of religion and religious belief emerged out of journalistic commentary on the contents and impacts of their books. A standard observation is that New Atheist authors exhibit an unusually high

level of confidence in their views. Reviewers have noted that these authors tend to be motivated by a sense of moral concern and even outrage about the effects of religious beliefs on the global scene. It is difficult to identify anything philosophically unprecedented in their positions and arguments, but the New Atheists have provoked considerable controversy with their body of work.<sup>4</sup>

Additionally, a 2006 Cable News Network article characterized New Atheism as “[The] belief that religion should not simply be tolerated but should be countered, criticized and exposed by rational argument wherever its influence arises.”<sup>5</sup>

The debate over atheism and belief in God is sometimes seen or suggested as a conflict between science and religion. Some appear to view science and religion as opposing one another and even to think they are mutually exclusive or contradictory. Yet the examples of accomplished scientists who believe in God and observe religious practices provide a striking counter-example to the claim that these two views are antithetical.

Careful consideration of the arguments and evidence in this debate is warranted in order to have a view consistent with reality and not merely informed by the ideas of prominent scholars or theologians. In our quest to understand and find truth, we must not prematurely discard unpopular or uncomfortable ideas but expend effort both to understand the philosophical underpinnings of science and to explore any spiritual sources of enlightenment.

This chapter considers several New Atheist arguments from a philosophy of science perspective while exploring the necessity of faith to scientific inquiry. It also elaborates on a religious concept espoused by The Church of Jesus Christ of Latter-day Saints that includes answers to prayer and an empirical way of knowing that God exists and that religious texts are true. This view, while not accepted by atheists, is philosophically defensible and stands as a compelling claim in opposition to atheism.

### **The Paradox of Atheism**

Atheism is a lack of belief in God. Such a position is curious in light of the following paradoxical thought experiment. Assume for the moment that there is no God. In such a case, the fact is that there would be no way to verify that there is *no* God. Suppose we wished to prove there is no God. We could begin by attempting to search the physical universe to ensure that we do not, in fact, find God. However, searching the universe is impossible — it is far too large. Moreover, any effort to search the physical universe would be unable to rule out the possibility that God exists in a spiritual realm. Because the number of possible ways to explore spirituality is vast, it is impossible to prove that God does not exist, either by searching the physical universe or through spirituality.



In contrast to the atheist claim that God likely does not exist, theism — the belief that there is a God — has the potential to be verified. This is so because if God exists, He can reveal Himself to us as individuals, thus proving His existence.

This thought experiment and the paradoxical nature of atheist belief falls short of proving the existence of God. Yet the fact remains that a claim that God does not exist is unverifiable, regardless of whether God actually exists. Notably, although atheists sometimes accuse theists of blindly believing in God, a belief that there is no God is always and will forever be blind belief in something unverifiable.

The statement that God's existence is verifiable (supposing that God exists) is not meant to oversimplify the complexity of determining whether God lives. If, in our quest to find God, we were to come across a being who claims to be God, this would not settle the question. One would undoubtedly want to find out for certain that any such majestic being is in fact God. Yet having a personal, spiritual experience with a divine Being and becoming certain that that Being is God — whether by the profound nature of the experience or by other miracles He performed — forever closes the door to atheism and firmly solidifies theist belief for that individual.

### **Considering New Atheist Arguments**

New Atheists make several arguments against belief in God that ultimately fall short of deciding the question of God's existence. This section summarizes several New Atheist arguments and provides an analysis and counter-arguments. The aim here is first to dispel the notion that belief in God is an untenable position and second to add clarity to the debate. Clarity and understanding ought to be the aim of any dialog on a topic as fundamental as belief or lack of belief in God. We must avoid

intimidation, obscurity, omitting facts, and making false claims, since our goal is a correct and enlightened view of reality.

### **Russell's Teapot and the Flying Spaghetti Monster**

"Russell's teapot" is the name given to a concept put forth by the late philosopher Bertrand Russell. Russell said that as far as common people were concerned, he could be considered an atheist, but from a technically philosophical perspective, he was agnostic. In an article on the subject of religion, he wrote:

If I were to suggest that between the Earth and Mars there is a china teapot revolving about the sun in an elliptical orbit, nobody would be able to disprove my assertion, provided I were careful to add that the teapot is too small to be revealed even by our most powerful telescopes. But if I were to go on to say that, since my assertion cannot be disproved, it is intolerable presumption on the part of human reason to doubt it, I should rightly be thought to be talking nonsense.<sup>6</sup>

He went on to compare this to religious claims about the existence of God.

A related concept that has been used in a logically equivalent — albeit sometimes insulting — sense is that of the Church of the Flying Spaghetti Monster (FSM). Adherents claim to believe that the FSM can perform godlike acts. Those who promote the FSM sometimes compare this "God" to traditional concepts of God, concluding that belief in the FSM is just as reasonable as belief in God. This comparison suggests that since the FSM is quite obviously the invention of a human mind, belief in God is as unreasonable as belief in the divinity of the FSM.

At their core both Russell's teapot and the FSM argue that the burden of proof for claims about the existence of an unfalsifiable entity like God lie with those who claim that such a being exists. These arguments make a valid point: we should not accept a claim merely because someone else believes it is true. And yet if an individual wishes to discover the truth about the existence of God, an investigation of the question and an exploration of potential avenues for discovering God's existence are necessary.

Here a scientific analogy is useful: I may doubt the claim made by Copernicus and Galileo that the earth revolves around the sun and instead believe that the sun revolves around the earth. I could look to the sky and argue that this is the simplest and most obvious interpretation of the daily rising and setting sun. If a patient individual came to me and wished to dispel this myth, he might suggest that I begin studying the movement of the stars each night so that I could discover the facts for myself. Faced with this proposal I could choose to dig in my heels, stick to my beliefs, and refuse to explore further. In so doing, I would believe a falsehood but would not need to expend any effort to learn that I was wrong.

Bringing this analogy back to the argument that the burden of proof lies with those claiming God's existence, if a skeptic wishes for enlightenment, he or she

cannot passively demand “proof.” The evidence for many claims — including many scientific ones — cannot be directly given to a person who asks. Instead, the evidence can be described (sometimes including figures and photos) along with instructions detailing the methods used to obtain the evidence. One can describe the observations that suggest the earth revolves around the sun — in which case a skeptic can choose to doubt that the description matches reality — but real proof comes by direct observation. No one can hand a proof that the earth revolves around the sun to a heliocentric skeptic. Instead, the proponent can point to a methodological formula for obtaining such proof: a set of instructions that will produce the same observations as others have had.

When it comes to belief in God, although I cannot *give* my observations of God’s existence to another person, I can *describe* them, and I can describe the methods I and others have used to make these observations. A skeptic may choose to dismiss my claims or can instead begin to explore the spiritual world through honest study of the scriptures and prayer. I propose that, as with my experience, this would bring spiritual manifestations: firsthand experience with the divine. Below I describe in more detail an LDS-based methodology for knowing God.

A final note: a requirement Russell gave for his imagined teapot is that it is too small to be detected by any telescope. The analogous position would be for a theist to argue that God exists but is imperceptible. Some theists may have this position, but there are many religions, including Mormonism, that claim God can be observed, and in general there is no reason to suppose we cannot observe God. Indeed, many claim that God is observable by ordinary human beings, not just prophets.

### **Intimidation and Mockery**

A tactic promoted by the biologist and prominent atheist Richard Dawkins is that of forcefully challenging believers and mocking their beliefs. Dawkins often emphasizes that atheists should not mock the believers themselves but should instead mock their ideas. He suggests challenging individuals as to their beliefs on selected topics for which a materialistic explanation may be lacking, and he employs a tone that emphasizes incredulity. In a recent talk to a large audience, Dawkins said:

When I meet somebody who claims to be religious, my first impulse is, “I don’t believe you. I don’t believe you until you tell me. Do you really believe,” for example, if they say they are Catholic, “Do you really believe that when a priest blesses a wafer, it turns into the body of Christ? Are you *seriously* telling me you believe that? Are you *seriously* saying that wine turns into blood?” *Mock* them. Ridicule them. In public. Don’t fall for the convention that we’re all too polite to talk about religion. Religion is not off the table. Religion is not off limits. Religion makes specific claims about the universe which need to be substantiated and need to be challenged and, if necessary, need to be ridiculed with contempt.<sup>7</sup>

One wonders what in our modern society would *necessitate* ridiculing religion with contempt, but more fundamentally, this statement and suggestion completely lack reason. Dawkins gives no argument here that atheism is a more enlightened worldview. Instead, he proposes an interchange that relies on emotion. The intent is to intimidate the believer and convey disdain for his or her views with a potential effect of public embarrassment or fear of being seen as irrational. To the extent that believers' views are unpopular, this sort of bullying has the potential to cow some believers into silence. Exploiting the potential unpopularity of a perspective ought to be unsettling to atheists whose views have historically been extremely unpopular or even dangerous to hold.

If atheism has merit, it ought to stand on and be promoted on those merits, not by intimidation or diminishing other people and their beliefs. Why is it that atheism seeks to win adherents through bullying? If, as the name of Dawkins's "Reason Rally" suggests, we wish to reason our way to a better understanding of reality, intimidation tactics have no place in our discourse.

On the subject of mockery, while Dawkins does advocate mocking others' beliefs only, the deeply personal nature of religion and belief (or lack of belief) makes it inevitable that mocking someone's beliefs will trigger an emotional response. As noted, such an approach inhibits the aim of clear dialog and rational analysis of the question of belief in God.

### **False and Overreaching Statements**

Atheism has at times been promoted using views that are false or unsubstantiated. This section gives just two egregious examples.

The first example is from Steven Pinker, a professor of psychology at Harvard University. In August 2013 he wrote an article about science and the humanities, indicating that scientific approaches are applicable to all areas of scholarly thought. One particular paragraph is noteworthy for the present discussion. In it Pinker argues that modern science has shown that religious concepts about the origins of life and human beings are incorrect.

We know, but our ancestors did not, that humans belong to a single species of African primate that developed agriculture, government, and writing late in its history. We know that our species is a tiny twig of a genealogical tree that embraces all living things and that emerged from prebiotic chemicals almost four billion years ago. We know that we live on a planet that revolves around one of a hundred billion stars in our galaxy, which is one of a hundred billion galaxies in a 13.8-billion-year-old universe, possibly one of a vast number of universes. We know that our intuitions about space, time, matter, and causation are incommensurable with the nature of reality on scales that are very large and very small.<sup>8</sup>

This statement is generally consistent with the scientific consensus, although Pinker's characterization emphasizes his own interpretation. The idea that there



are universes outside our own is controversial and unsubstantiated. Pinker's intent here is to argue that our earth — and perhaps even our universe — and mankind itself are not very significant. The facts given here agree with Pinker's own view and interpretation of the science. That being said, Pinker then departs from scientific fact:

There is no such thing as fate, providence, karma, spells, curses, augury, divine retribution, or answered prayers — though the discrepancy between the laws of probability and the workings of cognition may explain why people believe there are. And we know that we did not always know these things, that the beloved convictions of every time and culture may be decisively falsified, doubtless including some we hold today.<sup>9</sup>

The reality is that we *do not* know that there is no such thing as fate, providence, karma, spells, curses, or answered prayers. In fact, many trustworthy individuals — including scientists — claim that some of these things *do* exist. Most, if not all, religious convictions have *not* been decisively falsified. The article gives no citations, and such far-reaching claims cannot be substantiated.

Pinker's argumentative device here is to stand on the shoulders of the scientific statements made earlier in the paragraph and attempt to foist other completely uncertain claims as being on equal footing — even a logical consequence of — the earlier statements. And this is not the only instance in this article of his making unsupported statements: Jackson Lears, a professor of history at Rutgers University wrote a letter to the editor (now available online [4]) saying that a quotation of Lears's was falsely construed to suit Pinker's argument.

The second example of an overreaching statement is by Jerry Coyne, a professor of ecology and evolution at the University of Chicago. Coyne has written about free will, arguing that it is an illusion on the basis of "the laws of physics" and their supposed determinism. This argument is not new, and before scientists discovered quantum physics, it had a degree of plausibility. The argument is that the chemicals in your brain have a certain makeup that, in principle, allows for determining every action you would take in your life from the necessary derivations based on the laws of chemistry. The trouble with this claim is that we now know that at the molecular level, physical and chemical interactions are not deterministic. We could not predict every action you are going to take merely by knowing the chemical state of your brain. The laws of physics simply are not deterministic at the molecular level.

Here are Coyne's words from an article published in March 2012:

Free will is ruled out, simply and decisively, by the laws of physics. Your brain and body, the vehicles that make "choices," are composed of molecules, and the arrangement of those molecules is entirely determined by your genes and your environment. Your decisions result from molecular-based electrical impulses and chemical substances transmitted from one brain cell to another. These molecules must obey the laws of physics, so the outputs of our brain — our "choices" — are dictated by those laws. (It's possible, though improbable, that the indeterminacy of



quantum physics may tweak behavior a bit, but such random effects can't be part of free will.)<sup>10</sup>

Coyne fails to mention that gene expression is a stochastic process that is highly variable among cells even in the same environment, and he only admits that physics is not actually deterministic in the final, parenthetical statement. Coyne first says that the indeterminacy of quantum physics may “tweak behavior a bit” when in fact he has no idea of the extent to which quantum physics may tweak behavior. Our current techniques for observing active brains cannot delve deeply enough to observe molecular-scale interactions, so we simply do not know.

Curiously, Coyne goes on to claim that quantum physics “can't be part of free will.” While indeterminacy is of course not free will, Coyne has no argument to make. He cannot argue that our behavior is deterministic on the basis of physics since we are made up of elements that interact on the molecular scale. He cannot argue that behavior is non-deterministic, since we are able to make predictions about our own actions (i.e., by planning ahead, etc.). Is quantum physics the basis upon which free will operates? We do not know enough to say, and from a scientific perspective, we do not know how — or if — free will operates. What is certain is that much research remains to be done, but claiming that physics is deterministic is false, and subsequently concluding that free will is an illusion is dubious.

Regarding free will, Coyne says, “And deliberating about your choices in advance doesn't help matters, for that deliberation also reflects brain activity that must obey physical laws.” Coyne here does not mean to say that deliberation is fruitless; his is a statement about whether or not we can prove free will through the act of deliberation. Yet one wonders if we would be less inclined to deliberate

about the effects of our choices if we believed that free will does not exist. The social implications of a lack of free will are widespread. For example, should individuals be punished for crimes they did not actually choose to commit?

Coyne has no basis for ruling out free will. On the other hand, there is in all of us the intuitive sense that we have a will and an ability to choose between alternatives. Barring further evidence, it seems wise to maintain our intuitive senses about free will and to deliberate thoughtfully between alternatives.

### Scientific Arguments

Sometimes, scientific arguments against belief in God have been based on the theory of evolution. Other arguments are based on the multiverse hypothesis. This section discusses both these concepts.

**Evolution and Belief in God.** Before Darwin the fact that life exists was thought to be strong evidence of God's existence and of His creative power. With the advent of the theory of evolution by means of natural selection as Darwin proposed, the possibility of life being formed without God's involvement became a scientifically tenable position. Since that time, many have argued for or against the theory of natural evolution rather than that of divine creation. Most of these arguments are beyond the scope of this chapter.

As a geneticist, I believe that evolution explains the descent of all forms of life upon the earth, including mankind. However, I am keenly aware that no scientific evidence exists for or against the position that either (a) God set up the universe and the earth in such a way that evolution was carried out or (b) God has intervened in the evolutionary process, thus partially directing the formation of life. Many theist scholars have argued in favor of position (a), often using the analogy of a watchmaker, but it is noteworthy that position (b) cannot be falsified, either. While both these positions are distasteful to atheists who promote evolution as being at odds with the existence of God, still it is the case that no one has disproven them.

The relationship between God's involvement in human affairs and the strong evidence in favor of evolution is worth considering. I do not hold with those who believe that God *did not* intervene at various points in the history of life upon the earth. At the same time, I readily admit there is no physical evidence for God's intervention, and I think it unlikely we will ever recognize such evidence, if it exists. (The reason is that God's involvement would almost certainly appear similar to other natural effects, such as selection.) The idea that God has intervened in evolutionary history is unpopular in some circles, yet it remains a viable possibility.

Regarding God's existence, it does not follow that evidence in favor of evolution argues against belief in God. And merely because scientists agree upon a theory that does not invoke God does not mean the theory is a perfect descriptor of reality or that God was not involved. Scientific explanations aim to omit scientifically obscure

concepts such as God, but forming a theory that assumes God was not involved and then concluding on the basis of that theory that God does not exist is circular reasoning.

To be clear, I am not advocating that scientists start searching for evidence of God. Science rightly concerns itself with matters it can explain by natural means. We must be careful, however, when attempting to translate scientific discoveries into other areas, such as theology. If we wish to learn something theological from archaeological or genetic evidence, we should consider those observations in a theological sense, asking what relevance they may have. Some observations surely *are* relevant to theological questions, but they do not disprove God and cannot be used to dismiss the possibility of God's existence.

**The Multiverse Hypothesis.** Cosmology is the branch of physics devoted to the study of the origin and evolution of the universe. Discoveries made throughout the twentieth century in cosmology showed that certain fundamental constants of the universe make it extremely well suited for the formation of life. Moreover, it was found that if these physical constants had deviated by even a small fraction from their current values, stars and other essential physical structures could not form, and life as we know it would not be. The conclusions of these studies have suggested that we live in a “fine-tuned universe” — a universe that is finely tuned for life's existence.

Recently cosmologists have proposed a theory termed “the multiverse hypothesis,” which suggests that the physical constants of our universe could have arisen randomly. This hypothesis posits that many universes exist and that new universes are generated every fraction of a second, with the physical constants of each one taking on random values. If this hypothesis is correct, the argument is that with an uncountably infinite number of universes in existence, one will eventually



*Conceptual Representation of the Multiverse Hypothesis*

form that has constants set to values that are perfectly suited for life. The argument proceeds by invoking the anthropic principle, saying that since we are here to observe the physical constants tuned as they are, we should not be surprised by the fine tuning we observe. We observe tuning because we are in such a rare universe in which life can exist.

Several issues arise in using the multiverse hypothesis to argue against belief in God:

- There are, as yet, no observations to support this relatively new and little-evaluated hypothesis. Thus, at present, believing in this hypothesis as an argument against God is not rational: there is no evidence in favor of it.
- The predicted observations from this theory are indirect, so it remains to be seen how much empirical support the hypothesis will ever receive.
- Consistent with the above, there is a lack of consensus among cosmologists as to the validity of the multiverse hypothesis.
- Even if the multiverse theory is correct, it does not and cannot prove that God does not exist.

Given this state of things, forming theological conclusions based on multiverse would be misguided. Notably also, the multiverse proposal, while having many scientific implications worthy of exploration, may have been conceived as a response to the claims of a fine-tuned universe. Scientific theories derive from many sources, and forming a theory that points to a conclusion opposed to an existing theory is a valid means of furthering science. However, it is incorrect to conclude that God does not exist by virtue of a theory formed to refute another (arguably theistic) theory. Once again, that amounts to circular reasoning.

### **Rejecting 100% of Gods vs. 99%**

Dawkins has argued, “We are all atheists about most of the gods that humanity has ever believed in. Some of us just go one god further.”<sup>11</sup> This argument suggests that theists are very close to being atheists, and some versions of it use percentages to emphasize this point, saying that theists reject 99% of gods while atheists reject 100%.

Dawkins here modifies the meaning of “atheist” in a confusing way. Disbelieving one concept of God does not make a person an atheist, either about that God or any other. One must lack belief in all concepts of God to qualify as an atheist. The question under examination is not, “Which concept of God do you believe or not believe in?” Rather, the question is if you believe in a divine being at all. For example, Muslims believe in a very different concept of God than did those who worshipped Baal and Thor, yet all theists believe that divine beings exist. This is very different from atheists who do not believe in God.

Rather than being atheist about differing concepts of deity, theists hold some concept of God, and that concept may be closely related to or different from that

of others. Regardless of how much one concept of God is related to another, belief in a divine being unites all theists, and that is the very point on which theists and atheists disagree.

A separate issue arises in the quantification of “rejecting” 99% vs. 100% of gods. This is faulty math: most concepts of God are not independent of each other and so are not fully rejected by most theists. Religions have and do influence each other, and by embracing one concept of God, a person will invariably embrace aspects of other conceptions of God. For example, as a devout member of The Church of Jesus Christ of Latter-day Saints, I reject the view that God will damn those who, through no fault of their own, never receive baptism on earth. Many Christians espouse a different belief. Does that mean I reject their God? No, rather I reject one aspect of the God they worship. One could attempt to quantify the extent to which I reject various concepts of God, and in so doing they would find that not only do I agree with many aspects of traditional Christianity and Catholicism, I agree with many aspects of Islam and Judaism. Taking this a bit further, I hold that much of Hinduism and Buddhism is inspired and draws individuals closer to divinity. Hinduism and Buddhism have very different tenets than Mormonism, yet their teachings point individuals to sources of inspiration that lie outside themselves — to some form of divinity. Surely not all members of The Church of Jesus Christ of Latter-day Saints would agree with what I view as godly, but this is part of the point: religious interpretation and beliefs differ among individuals and religions, and that does not suddenly transform theists into atheists.

### **Scientific Inquiry: The Role of Faith and Verifiability**

The view that science and faith in God are very different (or even opposed to each other) is taken for granted in too many discussions. Examination reveals that science is completely dependent upon faith and that for some, belief in God can have underpinnings that are similar to those of science. This section discusses the role of faith and verifiability in the scientific enterprise, and a later section discusses the proposal that religious belief can be verified in a fashion that could be compared to the scientific means of verification.

In examining how much science relies on faith, I do not aim to discredit science or even to equate it with religion. I am a scientist, and I believe that science that is carried out ethically and methodically uncovers truth. The authoritative position society gives to well established scientific theories is generally valid: when scientific claims are testable or verifiable, they often lead us to a more accurate view of reality.

Faith enters science in two fundamental ways: scientists themselves depend on faith in order to carry out their work, and the lay public depends on faith in learning about and believing scientific theories. Below, I first discuss what faith is and then describe these two features of how faith is essential to science. Next I examine the role of verifiability in science.



### **What Is Faith?**

There are those who view faith as equivalent to blind belief, but this is not what faith is. The first dictionary definition for faith is “confidence or trust in a person or thing.”<sup>12</sup> Other definitions are related to devotion to God or a religion, and those are expressions of the aforementioned definition but are directed specifically to God or a religion.

Another definition of faith is “belief that is not based on proof.”<sup>13</sup> This definition may appear to be inapplicable to science, but in reality, few individuals actually observe scientific proof directly. Instead they have confidence or trust in scientists who report their observations and conclusions.

A final notable definition is from the Book of Mormon in Alma 32:21, which says that faith is to “hope for things which are not seen, which are true.” This definition implicitly proposes that there are true things we do not always see and that when we have faith, we hope for those true things. A scientist who trusts another scientist’s claims without verifying them him or herself is using faith when believing those claims.

### **Faith of the Public in Scientific Claims**

Most of us believe with little doubt the scientific claims that are widely known and for which there is strong scientific consensus, including the science taught in public schools. Examples of scientific claims that most people believe without their own evidence are: that the earth is round, that it orbits the sun, that germs cause illness and thus good hygiene helps prevent disease, that genetic material encoded in DNA is transmitted from parents to children, and that the universe and the earth are arguably several billion years old. Few if any have verified these claims, and because of economic and technical limitations, not even a small fraction of all scientific claims have been independently verified.



Scientific claims that make testable predictions, have stood the test of time (i.e., were proposed at least, say, a few decades ago), and for which there is clear consensus among the majority of scientists in the discipline are likely to be reliable. In this case, it is reasonable to feel confident that any conflicting findings would have been reported and the theories modified accordingly.

Absent rare exceptions, scientists are unlikely to have a conflict of interest: there is little if any reason for a scientist to hold back on reporting findings that disagree with previous reports. Overturning a well-established theory brings instant notoriety, and, at the same time, when scientists report a potential groundbreaking observation, they immediately make themselves vulnerable to scrutiny and criticism. Indeed, there are many examples, including several recent ones, where the scientific community has debunked new observations as the result of poor experimental design, faulty equipment, or errant analysis.

### **Faith Is Essential to Scientific Inquiry**

Beyond nonspecialists believing scientific authority, scientists themselves rely on faith — not faith in God, but faith even so — in their pursuit of discovering truth. Scientists utilize faith in two key ways.

First, when a scientist conducts an experiment, he or she does so on a form of faith. One cannot know before beginning an experiment whether or not it will work, and the majority of experiments or analyses fail. It is faith that enables scientists to persevere past setbacks and failure: faith that by continuing to adjust the experiment or by trying a wholly different technique, they will eventually acquire a greater understanding of their chosen questions. For some graduate students, such faith can wane when their experiments fail repeatedly, but faith is required for scientific progress and greater understanding to be achieved. Faith comes easier when prior successes feed the idea that future attempts will be worthwhile.

The second way scientists employ faith is in learning of and accepting the claims of other scientists. This occurs first when a scholar reads a paper or listens to a talk: the mere act of reading or listening is one of faith — faith that the effort and time will be worthwhile. In the process of internalizing the other scientist's report, the listener typically has faith that the observations are truthfully represented (though there is variation in this, and extraordinary claims receive much initial skepticism). Last, if the paper or talk appears sound, and if the listener believed it was truthfully reported, most often the new claims go unverified. Whereas it is possible for another scholar to redo the experiments described, he or she usually will not, but will rather accept them on the word of the scientist. All this process of accepting the claims of another scientist is an expression of faith.

It is essential for scientists to have faith in the (otherwise reasonable) claims of other scientists. To make progress, scientists learn from each other, and they do not conduct their work in isolation from the larger community. Scholarly publications





*Roger Bacon (1214-1294) Conducts an Experiment*  
 Colorized from an engraving in Michael Maier, *Symbola aureae*, 1617

and conferences enable scientists to convey their findings to each other, and one person's research often influences the inquiry and directions of another. Without faith and scientific integrity, progress would be extremely slow and cumbersome.

It is important to stress that the necessity of faith to science does not diminish science's standing. No purposeful act is carried out without faith, and scientific experiments and progress are no different. Faith in one's own ability to obtain enlightenment through well-designed experiments is, for those with the expertise and desire, typically reasonable, but it is still faith.

### **Independent Verification Justifies Scientific Authority**

In principle, scientific claims are verifiable by independent third parties. This characteristic, while not unique to science (more on this below), endows science with greater authority and trust than other disciplines. We cannot replay history to ensure that its telling is accurate, but scientific experiments can be performed more than once to ensure that results remain consistent across labs, etc.

To enable third party verification, scholarly papers describe how the authors collected the data for the study, their analysis methods, and the observations they

made. While papers usually do not describe every aspect of a study in perfect detail, yet, in practice, someone with sufficient training and adequate equipment would usually be able to repeat the experimental methods after carefully studying a paper. This property enables science to check itself, and since a unique claim has the potential to open new avenues of research and new understanding of our world, individuals do scrutinize such claims. Whether by reanalyzing the original data underlying a study or by collecting new data to check a claim, independent verification can and, for important findings, does occur. Claims for which a consensus develops over time within the scientific community will invariably have undergone scrutiny before they are widely accepted.

Even as scientific claims are in principle verifiable, it remains the case that verification itself involves faith. Redoing an experiment or performing an independent analysis requires an investment of time and the use or purchase of sometimes expensive equipment. Faith is evident in that the verifier must believe it is worth his or her time and sometimes laborious effort to check the claim — regardless of whether that effort is to support or overturn it — in addition to any equipment costs.

Once an individual verifies a claim he or she can begin to feel quite confident in its truth. At that point, the individual truly begins to see for him or herself that the claim is real, rather than merely having faith that it is (or, alternatively, is not).

### **Mormonism's Theology: Witnesses and Verifiability**

Mormonism proposes that we can all have personal revelation, a relationship with God, and spiritual manifestations confirming that the Book of Mormon is true. The claim that personal revelation is available to everyone is put forth by other faiths as well. If personal revelation is possible, then avenues exist for all of us to come to know that God lives by empirical means. That is, we can have direct experience with God. Obtaining a sound empirical basis for the notion that God lives (assuming this is possible) can become a powerful demonstration that God both exists and interacts with those who seek Him. Eventually one's faith in God's existence can become a sure knowledge, as God becomes an active, integral part of that person's life.

The remainder of this section outlines my own perspective on belief in God and religion. I have a profound belief in Mormonism and see it as having unique tenets that endow it with great power from God. I testify by my own experience that these unique doctrines are verifiable. In conjunction with my love and admiration for Mormonism and my allegiance to it, I am certain that God speaks through other faiths as well. I have felt God's spirit as I have worshipped with friends in various churches. Those that seek godly ways receive God's guidance and spirit. As a divine, all loving, and all knowing Being, God always answers the heartfelt and earnest prayers of His children, regardless of the name or shape they use to call on or think of Him. God is the good shepherd. He loves us and blesses those who love and



*The Desires of My Heart*, 2004. Walter Rane (1949-)

seek after goodness and godliness through uplifting worship of all varieties.

I commend those who seek to know God to seek proactively. It is worth the effort to take time to know God and to kindle a deep desire to understand whether He lives and what kind of Being He is. The words that inspired Joseph Smith to seek after Godly wisdom succinctly describe the process of how to obtain revelation from God:

If any of you lack wisdom, let him ask of God, that giveth to all men liberally, and upbraideth not; and it shall be given him. But let him ask in faith [i.e., actively and with hope that God can answer], nothing wavering [i.e., with a focused desire and belief that God can answer if He exists].  
(James 1:5–6.)

May James's words serve as an invitation to all who seek wisdom concerning the reality of God. He lives and loves all.

### **Witnesses of the Divinity of the Book of Mormon**

To begin exploring the possibility of belief in God, one first hears the witness and testimony of others, often through scripture and sometimes directly from someone else. Since The Church of Jesus Christ of Latter-day Saints was organized in 1830, individuals have recorded their testimony and witness of divine revelations they have received concerning the truth of the Book of Mormon, the reality of God the Father, Jesus Christ and the Holy Ghost, that Joseph Smith was a prophet, and that God loves His children.

When considering individuals who testify of these things, there are three possibilities: they were lying, deluded, or were actually seeing and describing reality. The notion that individuals were lying about these divine revelations concerning



Mormonism appears fatuous. There is no meaningful benefit to lying about a testimony of Mormonism. No one has ever received monetary gain for declaring these things. Moreover, members of the LDS church have been mercilessly persecuted in the past, and such persecutions, while less extreme and less obvious now, still continue today. Indeed, testifying of God or Mormonism today can bring risks to individuals' careers or reputations. Because of this, I do not believe that any sizable fraction of the testators to the authenticity and divinity of the Book of Mormon or the LDS Church were attempting to deceive others. Instead, it seems evident that these were their deeply held beliefs.

Ascertaining whether or not someone is delusional cannot be done easily, nor is the accusation of delusion a light matter. Having been told, myself, I was delusional on numerous occasions, I have come to realize a few features of this claim, as elaborated below. For the present discussion, I note that we have no evidence at all to suggest that those who have and do testify of the LDS Church are delusional. Further, the LDS faith and spiritual manifestations that believers describe brings them comfort and reassurance. This contrasts strongly with the standard experience of delusion in which an individual often feels an overpowering fascination and strong emotional attachment to the delusion, to the exclusion of day-to-day responsibilities and otherwise positive life experiences. As we lack evidence for delusion and observe positive effects of these believers' spirituality, dismissing these testimonies quickly or arbitrarily appears misguided.

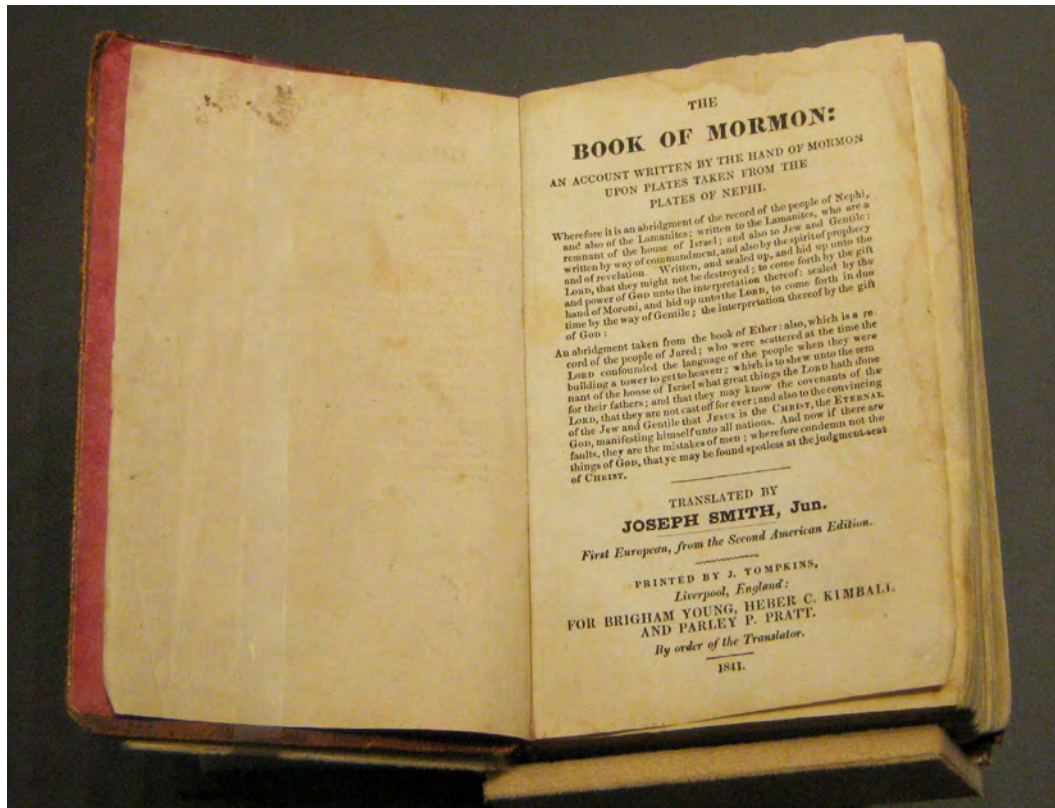
Given the status of these witnesses as possibly true, and in light of the varied and important implications of Mormonism if it is true, exploring Mormonism is justified. As such, the question becomes: how can we as individuals decide for ourselves if the LDS Church is true? Note that some of the proposals outlined hereafter apply to religions besides Mormonism. I examine the LDS Church because of my allegiance to it and because it focuses more than some faiths on the importance and opportunity of obtaining direct witness for oneself that God lives and that Mormonism is true. That is, it is perhaps more empirical in its directives for obtaining a testimony than many other religions, and I find that perspective appealing.

### **Verifiability of the Book of Mormon and God's Existence**

In October, 2003, the late Elder Neal A. Maxwell of the Quorum of the Twelve Apostles, when speaking about Joseph Smith, said:

The "choice" translator brought forth — "by the gift and power of God" (D&C 135:3) — the Book of Mormon, *something tangible and verifiable*. For all who heed it, the Book of Mormon is like the flinging open of long-closed doors on what was assumed to be a complete canon of scripture.<sup>14</sup>

As one of the highest authorities of the LDS Church, the words of this apostle carry weight, and he suggests that the Book of Mormon can be verified. As independent



verification is one of the key reasons that science has the special recognition it does, such a claim stands out.

Although Elder Maxwell does not elaborate further on verification in the aforementioned talk, anyone familiar with the Book of Mormon knows of the promise of a divine witness from God that is recorded in the final chapter of the book:

And when ye shall receive these things, I would exhort you that ye would ask God, the Eternal Father, in the name of Christ, if these things are not true; and if ye shall ask with a sincere heart, with real intent, having faith in Christ, he will manifest the truth of it unto you, by the power of the Holy Ghost. (Moroni 10:4.)

The method is simple, but it requires a level of psychological awareness and clarity of desire that may take effort to acquire.

The specific requirements for obtaining an answer, as outlined in this verse are as follows. Implicitly, first you must have a desire to know if the book is true, and you must study and read it (see the previous verse, Moroni 10:3). Second, you must pray, and you must do so with a sincere desire to know if the Book of Mormon is true. Third, you must have “real intent.” Fourth, you must have faith in Christ.

Before elaborating on these requirements, I wish to emphasize the depth of this message. Moroni is suggesting the possibility — and many confirm the

experience — of having a divine manifestation of the truth of the Book of Mormon. Furthermore, the requirements for receiving such a profound manifestation can be and are written down in one short verse along with the promise. Few religions make claims such as this: pray earnestly, with great desire, and with belief that God can answer, and He will answer you, confirming the words of a book of scripture to be true. It is a staggering promise and one that the LDS Church rests on in order to invite individuals to join its ranks.

The requirements listed above describe what we could call a “method” for obtaining revelation from God, arguably related somewhat to methods described in scientific papers. And the prediction (or promise) Moroni gives is that God will manifest to you, by the Holy Ghost, that the Book of Mormon is true. How this manifestation occurs differs from person to person, yet despite some variation, the promise is that a witness from the Holy Ghost, one of the three members of the Godhead, will come to those who seek. Most often this manifestation takes the form of a spirit of great peace and solace, a spiritual feeling that is deep and profound enough to convince one that it comes from God Himself.

One can view the method outlined in Moroni 10 and the prediction given in comparison to scientific claims. Using astronomy as an example, science teaches that I can come to see with my own eyes that the earth revolves around the sun by studying the constellations. To obtain these observations requires effort. Specifically, I must desire to see the reported observations in the first place, then I must act on that desire by studying the constellations, and I must devote some of my time to that study. These requirements to verify science mirror some of the requirements in Moroni 10 listed above.

A key strength of science is that if someone doubts scientific claims, he or she can redo experiments. Mormonism stands on similar footing: if someone wants to know whether the witnesses of the Book of Mormon are correct, he or she can expend the same effort that previous witnesses did, and he or she can have the same sort of manifestations about it.

Lest my brief summary of what is being proposed in Moroni 10 be misunderstood, I will clarify that the suggestions here are ones that often require soul-searching evaluation to obtain. The psychological requirement does not have a parallel in the physical sciences. I can be angry that the stars move the way they do, but unless I shut my eyes or do not look at them, I will still see them move just as they do. (Of course, my attitude could bias what I choose to look at in the cosmos and how hard I try to interpret it in my preferred way.) Having an attitude of sincerity and resultant humility when approaching God is one of the requirements Moroni mentions, and while this seems intuitively sensible on religious matters, such an attitude is possibly less important when performing traditional science.

The final requirements in Moroni 10:4 are to have “real intent” and faith in Christ. Clayton Christensen, a devout Mormon and Professor at Harvard Business School

has suggested that “real intent” here is not the same as being sincere, since the immediately previous phrase speaks of sincerity. Instead, Christensen proposes that this means to have an intent to act on the knowledge if it is given .

Elaborating on this, I believe God wants to reveal Himself to us and have His Spirit dwell with us, but I also believe that He gives these powerful manifestations to those who show Him they are ready for such responsibility. Knowledge of moral matters and of the purpose and nature of life convey a great responsibility on the recipient. For example, suppose I know there is a God and that He expects me to live by a high moral standard. If with this knowledge I then disobey God’s commands, my fault is much greater than if I disobey without knowing the commands are truly from God. In requiring deep commitment and a willingness to change one’s life before God will answer, God prevents those who are merely curious about Him from being condemned for receiving a quick answer to a fleeting curiosity and then disobeying Him. One must have intent to act, one must be committed to giving their life to Godly ways and His will for them, and then God will answer.

Some may misunderstand the meaning of having faith in Christ and think that Moroni 10:4 is circular. Joseph Smith, in the *Lectures on Faith*, said that “Faith is ... the principle of action in all intelligent beings.”<sup>15</sup> All purposeful acts are based on some degree of faith. Thus merely opening the Book of Mormon or any book at all is an act of faith. And this is akin to the faith scientists use when reading scholarly articles.

Moroni suggests having faith in Christ, not to believe a priori that the Book of Mormon is true. I suggest that this means to have faith enough to take action by *asking in prayer* and to believe in the *possibility* that God can answer because of the grace of Christ. The belief in the possibility that God can answer is related to the kind of faith that scientists employ in the laboratory. Scientists do not know ahead of time whether their experiments will work, but they have faith in the possibility that they could work, and that faith motivates their *action* of experimenting.

As with Galileo’s claim that the earth revolves around the sun, if you wish to know for yourself that the Book of Mormon is true, you must not be passive. You can accept or reject Galileo’s claim, but either position is one of faith. You can accept or reject the Book of Mormon’s claims to authenticity and divine inspiration, but either position is one of faith. Rejecting it risks remaining in metaphorical darkness as to the truth of God’s existence and of the Book of Mormon.

### **Personal Experience as a Reason for Belief**

The notion that revelation, if it occurs, would be somewhat scientific is supported even by the well-known atheist, Richard Dawkins. In the quote below, Dawkins is discussing one among a set of arguments for God that were proposed by theologians at a conference in Cambridge in which he participated.

The most important of these other ways of knowing [besides ones previously listed] turned out to be personal, subjective experience of God. Several discussants at Cambridge claimed that God spoke to them, inside their heads, just as vividly and as personally as another human might. I have dealt with illusion and hallucination [elsewhere in this book], but at the Cambridge conference I added two points. First, that *if God really did communicate with humans that fact would emphatically not lie outside science*. God comes bursting through from whatever other-worldly domain is his natural abode, crashing through into our world where his messages can be intercepted by human brains — and that phenomenon has nothing to do with science? Second, a God who is capable of sending intelligible signals to millions of people simultaneously, and of receiving messages from all of them simultaneously, cannot be, whatever else might be, simple. Such bandwidth! God may not have a brain made of neurones, or a CPU made of silicon, but if he has the powers attributed to him he must have something far more elaborately and non-randomly constructed than the largest brain or the largest computer we know.<sup>16</sup>

While I disagree with Dawkins on most theological positions, I find myself agreeing with much of this quote. Curiously, Dawkins wrote this in the context of a chapter devoted to dismantling arguments for God, yet here he says little against this approach to knowing God. Not only does he not claim that this is a poor argument, he indicates that it is relevant to science and that a God capable of communicating with humans is powerful indeed. His response first suggests that this may be hallucination, but as discussed previously, there can be no proof that a believer is delusional, and there may be countervailing evidence against it. For example, the lives of those receiving revelation are otherwise normal, and they *benefit* from these experiences. What repeated hallucination or delusion leaves the well-being of the recipient overall *improved*?

Dawkins also hints here that the complexity of a God capable of communicating with humans is somehow a reason for disbelieving that such a being exists. If that is Dawkins's position, it is at odds with scientific progress and research. Numerous scientific concepts are complex and are not yet fully understood (e.g., the human mind, the cosmos, etc.). Because we observe the effects of these phenomena, we accept them as real and set to the lofty task of understanding their workings. If we then begin to personally experience and observe God's effects in our lives, should we not accept Him as real? Parsimony of explanation has a good place in science, but when we observe complex phenomena, we must open our minds, admit they exist, and set out to more fully understand them by active inquiry. We adjust our view of the world when we see evidence of forces we had not seen before. That is how science progresses and that is a good attitude to have toward God.



### My Testimony

I copy here the testimony I wrote for the website *Mormon Scholars Testify*.<sup>17</sup> Many LDS scientists and scholars have submitted their testimony to this website and they are worth reading.

My testimony of the truth of The Church of Jesus Christ of Latter-day Saints and that of the Book of Mormon is certain. I say without any hesitation that I possess a knowledge that there is a God in heaven and that He has revealed Himself to me. That knowledge has come not through physical demonstrations or by reason alone, but by God's Spirit speaking to me personally, in a manner that could only have come from God. This knowledge and the relationship I have developed with my Maker have carried me through many difficulties, and I am grateful beyond measure to know these things for myself. Without a doubt, knowing the reality of God and of the truthfulness of His Church is the greatest blessing of my life.

Although my belief is certain now, it was not always so, and answers to my inquiries about God and religion did not come immediately when I asked.

I gained my knowledge of the reality of God and the truth of the Book of Mormon at a time of personal struggle. At the age of eighteen, having just finished my freshman year in college, I came to feel that I needed to know for myself whether there was a God and whether the things I had been taught in Mormonism as a child were true. To that point, I had prayed intermittently and had read — though somewhat irregularly — from the Book of Mormon, with an occasional inquiry to God asking to know if it was true. No answer that I could recognize came, and I wondered why my asking did not produce the answer that the Book of Mormon promises and if I was asking in the right way. However, despite the lack of an answer, I continued to believe in Mormonism because so many of its teachings made sense to me. The most compelling claims to me included the belief that God continues to send prophets to the earth in modern times, that God can and does speak by personal revelation to ordinary, lay members of the Church and not just to its leaders, and that spiritual gifts are available now, just as in ancient times. On this basis I formed a belief, yet I wondered when and if my prayers to know definitively concerning God and religion would be answered; I was sure that if Mormonism was true, I too had claim on personal revelation. In my early teenage years, I made the determination to stay true to Mormonism for a period of time, since I could not then decide whether it was true or not. If, by the time I reached twenty-one, I had not experienced divine revelation, I planned to reevaluate these questions.

It is now clear that the primary reason I did not recognize any answers to my prayers or perceive a witness about the Book of Mormon as a young teenager was because I put forth little effort and had only a small desire for an answer. Though I did want to know, I did not put my heart and soul into prayer the way I did years later.

My freshman year in college was an exciting one, as I had the opportunity to deepen my understanding of subjects I felt passionate about and also had the chance to interact with a wider range of individuals than I had grown up with. I attended the University of Utah, and although this campus is located in Salt Lake City, there were a large number of students who were not Mormons, and this was especially true in the sciences and in engineering.

I became good friends with a small group of atheists and agnostics and felt eager to share my beliefs with them, thinking that they would see the uniqueness of the tenets of Mormonism and would want to learn more about the Church. I am grateful for these friends and the discussions we had because I have had dozens more since then with other sincere disbelievers among my classmates, colleagues, and friends in academia. My freshman classmates challenged my beliefs in ways that were often constructive but also introduced me to the experience of being mocked and belittled for belief in God. Such is the persuasive device that some revert to in an attempt, if not to refute faith, at least to intimidate faith's adherents. (Paradoxically, atheism involves a unique style of faith that is not practiced by believers because, if God does exist, His presence has the possibility of being verified through divine communication, whereas a claim that there is no God can never be substantiated by any kind of evidence.)

I came away from these discussions with a greater desire to know for myself — sooner rather than later — if there were a God. If there were no God, I had no interest in aligning myself with a religious institution.

The questions that arose at this time served as a backdrop to a great challenge that came a short while later when I had a falling-out with a close friend that left me feeling sad and somewhat lonely.

In these circumstances, my attitude regarding the question of religion and God was quite different than it had been in prior years. I turned to my Maker and to the scriptures — most especially to the Book of Mormon and other modern revelations — with an eager yearning to know if God really lived. I asked in prayer more sincerely than I ever had before if there were a God and if the Book of Mormon were true. I read God's word with more intensity and desire than ever before. I needed to know. And I felt certain that if there were a God, and if The Church of Jesus Christ of Latter-day Saints were true, I would receive an answer as I had heard so many other members of the Church describe having received.

Through the act of reading the Book of Mormon and praying concerning it, I was following the invitation contained in its pages to "experiment upon the word" (Alma 32:27-37, 41-42). The book's predicted outcome of this experiment is divine communication confirming that the book is of God and is true (Moroni 10:3-5).

I did not have to wait long before discovering a sweet peace flowing into my heart both as I prayed and as I read scripture. This peace contrasted sharply with the feelings of sadness and loneliness that were otherwise in my heart. Soon my

desire to commune with God became frequent and deep. In the ensuing year, I often poured out my soul in private, seeking to know more of the Being who filled me with such peace and hope, feelings that otherwise seemed so elusive. The results of my experiment proved to be consistent with the outcome predicted in the Book of Mormon.

Through all of this I came to know that God does live and that He is the Father of my spirit; that He is a loving, tender, and devoted parent; and that He is keenly aware of me and my life. I came to know that God lives as certainly as I know that I exist. The spiritual manifestations that came were poignant and so sharp and profound at times that I knew my own mind could not conjure them. When I felt a heaviness of heart, I would turn to my Father in Heaven and, shortly thereafter, I would come away feeling buoyed up, lightened, and hopeful about the future. Sometimes the state of mind I was in before seeking God's support was heavy indeed, and the lightness and strength that came into my heart and soul through earnest seeking were the polar opposite of what I had felt beforehand.

I am a witness to the reality of the promise given throughout scripture, "seek and ye shall find" (Matthew 7:7-11). That phrase and other semantic equivalents are among the most common to occur in scripture. God is eager to reveal Himself to us. Despite His eagerness, however, God wants us to be clear — both to Him and to ourselves — that we really desire the manifestations we ask for. Receiving a knowledge that God lives has the power to fundamentally change the course of one's life and carries with it some responsibility (Alma 32:17-19). Because God does not wish to burden an individual with the responsibility of knowing concerning Him without that person's having a deliberate and earnest desire to know, His answers to some inquiries may be subtle and difficult to recognize.

In the varied conversations I have had with my disbelieving friends — and friends they are! — I have sometimes been accused of being brainwashed or deluded. I have considered these ideas very seriously because I know that our minds are complex and that self-deception is a possibility. Reflection has convinced me that my experience is simply too profound and too distinct from what I might envision by my own mental devices to be accounted for as springing from within me.

To some, this statement affirming a divine source of my spiritual experiences may not carry much weight. I offer three points in answer. First, one who dismisses my accounting of spirituality — or that of countless others — as delusional is deeming him or herself better judges of my experience and psyche than I am, even though he or she was not present during these experiences. Second, if such a person has not sought or had spiritual manifestations for him or herself, and if he or she has not experimented with prayer as I and others have, his or her pessimistic explanation about the fruitful results of others' efforts is at best hollow. Third, there is simply no evidence that I or other believers are delusional. Those claiming delusion rely on blind faith — blind disbelief — to support their claims that another's mental state is flawed.

The evidence I have in support of the truth of The Church of Jesus Christ of Latter-day Saints grows with time as I continue to seek to know God and to live by His teachings. The experiences I had when I was eighteen were only the beginning of what has become a rich and vibrant part of my life, and I now turn to God daily to deepen a relationship that provides me with support and answers to life's challenges. The depth and persistence of my connection to God expands, though in a nonlinear way, as I strive to devote myself more and more to Him. Because of my faith, I see others on this earth as my spiritual brothers and sisters with infinite divine potential. I vaguely glimpse the immensity of God's love for His children, and I am in awe of the Creator of the universe, our Heavenly Father.

I testify that God lives and loves us. I testify He knows your name just as He knows mine. He will answer any and all who earnestly seek a witness of His reality. You can know for yourself, independent of anyone else, that God lives and loves you. You can know that the Book of Mormon is true and that prophets are again on the earth, speaking boldly concerning proper morals and providing a code of conduct for life. As I have, you can feel a peace permeating through your heart that carries and sustains you and leads you to learn of God's plan for your life.

Most fundamentally, what draws me to Mormonism is the claim that all can know for themselves — through “experimenting upon the word,” as the Book of Mormon invites — that God lives and that Mormonism is true. I invite all to experiment upon the word as I have.

### **Conclusion**

The debate concerning God's existence will continue for as long as human beings live on earth. Educated individuals on both sides of the debate have written and do write on this topic, yet few talk of an empirical means of knowing God. The God of Heaven and Earth does live and can be known by all. May those uncertain of God seek Him with great desire and sincerity. In so doing, they will discover His influence and receive a degree of peace and hope that is not possible by other means. I pray God will whisper peace to your soul and comfort in your journey through life. May you find Him, know Him, and experience firsthand His intervening miracles and boundless love.

### **Acknowledgments**

I wish to thank those who have had discussions with me over the years on the topic of belief in God, including — and perhaps especially — those of atheist persuasion. These friends have asked meaningful and genuine questions that, while unsettling when I first considered them, pushed me to think carefully and deeply about my chosen faith and if it is true. I also thank the many religious leaders and teachers I have had over the years who have helped me see God's hand in their own lives,

the lives of those in the scriptures, and ultimately in my own life. Hearing of these individuals' experiences inspired me to seek out my own witness of God's existence. I am also grateful the Interpreter Foundation for allowing me to present on this topic as a speaker and in writing. Finally, I thank Michael Cotter for reading parts of the draft of this manuscript.

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# SCIENCE AND GENESIS: A PERSONAL VIEW

Jeffrey M. Bradshaw

**T**he book of Genesis has always been a favorite of mine. Since I was a small child, I have read it repeatedly, relishing its spiritual truths, its literary beauty, and its frank and vivid descriptions of the lives of the patriarchs — intimately entwined as in no other book of scripture with the lives of their immediate and extended families.

While fellow Latter-day Saints will have little problem comprehending my still-growing attachment to the early narratives of Genesis, some of my non-LDS scientific colleagues might understandably find it mystifying that I have devoted so much time and attention to a study of what may seem to be no more than a fanciful collection of worn-out fables — one more shard among the dusty discards of the almost bygone religious passage of Western culture. In that regard, it must also be admitted that the central historical claims of Mormonism — and Christianity<sup>1</sup> itself, for that matter — hardly appear any less fantastic to the modern mind than the stories of Adam and Eve.<sup>2</sup> Even in the nineteenth century, Charles Dickens<sup>3</sup> approved as Hannay charged the Mormons with “the absurdity of seeing visions in the age of railways” — simultaneously commending our “immense practical industry” while decrying our “pitiable superstitious delusion.”<sup>4</sup> His conclusion at that time is one that would be met with understanding nods by many perplexed observers of Mormonism in our day: “What the Mormons do, seems to be excellent; what they say is mostly nonsense.”<sup>5</sup>

## **Taking the Stories of Primeval History Seriously**

Given their status as targets of humor and caricature, the well-worn stories of Adam, Eve, and Noah are sometimes difficult to take seriously, even for some Latter-day Saints. However, a thoughtful examination of the scriptural record of these characters will reveal not simply tales of “piety or ... inspiring adventures”<sup>6</sup> but rather carefully crafted narratives from a highly sophisticated culture that



*Donald Duck Gathers the Animals to the Ark, from Walt Disney's Fantasia 2000, 1999*

preserve “deep memories”<sup>7</sup> of revealed understanding. We do an injustice both to these marvelous records and to ourselves when we fail to pursue an appreciation of scripture beyond the initial level of cartoon cut-outs inculcated upon the minds of young children.<sup>8</sup> Hugh Nibley characterized the problem this way:<sup>9</sup>

The stories of the Garden of Eden and the Flood have always furnished unbelievers with their best ammunition against believers, because they are the easiest to visualize, popularize, and satirize of any Bible accounts. Everyone has seen a garden and been caught in a pouring rain. It requires no effort of imagination for a six-year-old to convert concise and straightforward Sunday-school recitals into the vivid images that will stay with him for the rest of his life. These stories retain the form of the nursery tales they assume in the imaginations of small children, to be defended by grown-ups who refuse to distinguish between childlike faith and thinking as a child when it is time to “put away childish things.”<sup>10</sup> It is equally easy and deceptive to fall into adolescent disillusionment and with one’s emancipated teachers to smile tolerantly at the simple gullibility of bygone days, while passing stern moral judgment on the savage old God who damns Adam for eating the fruit He put in his way and, overreacting with impetuous violence, wipes out Noah’s neighbors simply for making fun of his boat-building on a fine summer’s day.<sup>11</sup>

Adding to the circus-like atmosphere surrounding modern discussions of Noah’s flood are the sometimes acrimonious contentions among fundamentalist proponents concerning the different theories about where the Ark came to rest.<sup>12</sup> Nicolas Wyatt reports:<sup>13</sup>

I once watched a television programme of excruciating banality, in which a camera team accompanied an American “archaeologist” (for so he called himself) on his quest for the remains of Noah’s Ark on Mount Ararat. The highlight for me occurred when a rival crew was encountered at several thousand feet ... above sea level heading in the opposite direction, on the same quest!





*In Search of Noah's Ark, 1976*



*Enki Inserts a Computer Disk*

Unfortunately, Mesopotamian studies are no more exempt from such quackery than is Old Testament scholarship. The following description by Sasha Lessin, PhD, for the figure above recounts:<sup>14</sup>

Galzu tells Enki (depicted with his snake icon) to warn Ziasudra [*sic*] (touching the “wall” — probably a computer bank, depicted with Xs across the screens and slots for programs) of the Flood. Galzu guides Enki’s arm to convey tablet (possibly a computer or holo disk. The disk leaves Enki’s hand en route to Ziasudra’s computer).

Below is a photograph of Russell Crowe as Noah in a film that Paramount officially called a “close adaptation of the biblical story.”<sup>15</sup> Bible readers will, of course, agree with director Darren Aronofsky’s description of Noah as “a dark,



*Russell Crowe as Noah*



*A "Watcher" on the Attack*

complicated character' who experiences 'real survivor's guilt' after surviving the Flood."<sup>16</sup> Accordingly, he portrays the prophet with perfect scriptural fidelity as a "Mad Max-style warrior surviving in a pseudo post-apocalyptic world."<sup>17</sup> Students of the Bible will also surely recognize the portrait at left as one of the "Watchers," depicted in exact correspondence to the graphic novel that inspired the movie as "eleven-foot-tall fallen angels with six arms and no wings."<sup>18</sup>

The profound accounts of primeval history deserve better treatment. To understand them for what they are, we need to bring our best to the task: the powerful tools of modern science and scholarship, the additional light shed by modern revelation, and, of no less importance, the consecrated dedication of inquiring minds and honest hearts diligently seeking divine inspiration. The simple fantasies of a "fanciful and flowery and heated imagination"<sup>19</sup> will not suffice.



*Adapted from Jean-Leon Gerome, 1824-1904, Dante and Virgil [Nibley] in Hell, 1850*

I would like to share some personal lessons learned in my study of the first eleven chapters of the book of Genesis and in the LDS book of Moses. I will summarize these perspectives under five headings, illustrated by examples from scripture.<sup>20</sup>

Throughout this chapter I will draw heavily on the writings of that insightful pioneer, Hugh Nibley, who has served as a baptized Virgil for me in my journeys "into the blind world"<sup>21</sup> of mortality described in the primeval history of the Bible.<sup>22</sup>

**Lesson 1: *God's plan is more vast, comprehensive, and wonderful than we might imagine.***



*Carl Sagan,  
1934-1996*

Even some of the most doubting of scientists have stated their willingness to keep their mind open to the possibility of a God — so long as it is a God “worthy of [the] grandeur”<sup>23</sup> of the Universe. For example, the well-known skeptic Richard Dawkins stated: “If there is a God, it’s going to be a whole lot bigger and a whole lot more incomprehensible than anything that any theologian of any religion has ever proposed.”<sup>24</sup> Similarly, Elder Neal A. Maxwell approvingly quoted the unbelieving scientist Carl Sagan, noting that he:<sup>25</sup>



*Neal A. Maxwell,  
1926-2004*

perceptively observed that “in some respects, science has far surpassed religion in delivering awe. How is it that hardly any major religion has looked at science and concluded, ‘This is better than we thought! The Universe is much bigger than our prophets said — grander, more subtle, more elegant. God must be even greater than we dreamed’? Instead, they say, ‘No, no, no! My god is a little god, and I want him to stay that way.’”



*Joseph Smith, Jr.  
1805-1844*

Joseph Smith’s God was not a little god. His God was a God who required our minds to “stretch as high as the utmost heavens, and search into and contemplate the darkest abyss, and the broad expanse of eternity”<sup>26</sup> — that is more of a stretch than the best of us now can tolerate. Although the Ninth Article of Faith says explicitly that God “will yet reveal many great and important things pertaining to the Kingdom of God,”<sup>27</sup> the general rule is that such revelation will come only “when we’re able to understand it.”<sup>28</sup> The Prophet mourned that “things that are of the greatest importance are passed over by the weak-minded men without even a thought” — a phenomenon that made him want to “hug [truth] to [his] bosom” all the more.<sup>29</sup> “I believe all that God ever revealed,” said the Prophet, “and I never hear of a man being damned for believing too much; but they are damned for unbelief.”<sup>30</sup> He complained that he had tried “for a number of years to get the minds of the Saints prepared to receive the things of God” but that they would frequently “fly to pieces like glass as soon as anything comes that is contrary to their traditions.”<sup>31</sup> He compared the “difficulty in getting anything into the heads of this generation” to splitting the hardest of logs with the flimsiest of tools.<sup>32</sup>

The Prophet ran into that kind of trouble when he received section 76 of the Doctrine and Covenants. Many were shaken and some apostatized because they could not broaden their narrow sectarian notions of heaven and hell to encompass the glorious doctrine of the multiple gradations of glory.<sup>33</sup> More recently we have seen this same phenomenon at work in the unwillingness of some Saints to give





Noël Pisano, *Negative of Hand and Red Dots*,  
Cavern of Pech-Merle, Cabarets, France, ca. 2004



*Seven Hands*, Cavern of Pech-Merle,  
Cabarets, France.

up the outmoded idea that the Book of Mormon peoples were confined to the boundaries of North America.<sup>34</sup>

With these precedents in mind, we come to the topic of this chapter. Genesis and the book of Moses invite us not only to stretch our minds to consider how God's work extends *beyond* our own earth to include the salvation of "worlds without number"<sup>35</sup> but also stretch our minds to consider the vastness, comprehensiveness, and wonder of God's plan for all creatures who have lived and will live on *this* earth.

The beautiful copper engraving<sup>36</sup> above by Noël Pisano was made from meticulous observation of one of the many prehistoric paintings in the caves of Pech-Merle, in the heart of the *massif central* of southern France.<sup>37</sup> Although the cave walls and ceilings contain many images of greater sophistication, this simple tracing of a single hand appeals to me. Its original is solidly dated to 25,000 years ago, yet in standing to examine it in close quarters, the gap of time between oneself and the skilled artist is suddenly erased, and we are brought to admire the beauty and subtlety of his technique. To create this work, the artist had to crawl into the cavern by candlelight. After contemplating his design and choosing the ideal place for its execution, he placed his hand on the wall to serve as a stencil. To create the colored outline, he projected pigment onto the rock by blowing, perhaps with the help of a sprayer held tight in his lips.<sup>38</sup> This well-honed technique allowed a negative of the hand, surrounded by symbols whose meaning is now is lost to us, to be preserved tens of thousands of years later as an ancient snapshot, the sole remaining memory of the life of this individual.

In another chamber, we find what is undoubtedly a family portrait. Fourteen hands of adults and children are found together here, in a deep, submerged section of the cavern now accessible only during periods of drought. The creators of such relics “almost certainly intended them to last for generations.”<sup>39</sup> Elsewhere in the cave, visitors are moved to discover a dozen footprints of an adolescent boy drawn into this place by unknown rites, hostile forces of nature, or the mere boldness of curiosity — and preserved intact for twelve thousand years in the clay of the cavern floor.<sup>40</sup>

Hugh Nibley, with his great love of God’s creation,<sup>41</sup> had great sympathy for these ancient individuals and pondered long and hard about how their stories fit in with those of Adam and Eve. For a thoughtful perspective on this issue, we can do no better than to cite him directly:<sup>42</sup>

The philosopher Arthur Schopenhauer, in his *Essay on the Christian System*, said that the two fatal flaws of Christianity were (1) denying spirit and mind to any other creatures but ourselves and (2) allowing life on no other world but our own.

...

This ... should be no concern [for us]. ...

Do not begrudge existence to creatures that looked like men long, long ago, nor deny them a place in God’s affection or even a right to exaltation — for our scriptures allow them such. Nor am I overly concerned as to just when they might have lived, for their world is not our world. They have all gone away long before our people ever appeared. God assigned them their proper times and functions, as He has given me mine — a full-time job that admonishes me to remember His words to the overly eager Moses: “For mine own purpose have I made these things. Here is wisdom and it remaineth in me.”<sup>43</sup>

It is Adam as my own parent who concerns me. When he walks onto the stage, then and only then the play begins. He opens a book and starts calling out names. They are the sons of Adam, who also qualify as the sons of God, Adam himself being a son of God. This is the book of remembrance from which many have been blotted out.

From this same perspective, it is significant that the Book of Mormon, as a history of those who were Nephites by lineage or “adoption,” records only incidentally the story of the Lamanites and their associates.<sup>44</sup> So also the book of Moses tells us very little about the history of the Cainites or of the children of Adam that were born before Cain and Abel<sup>45</sup> who “followed Satan by choice and were disqualified as sons of God.”<sup>46</sup> The account instead focuses on the inauguration of temple ordinances among the righteous, which began, as Nibley indicates, “when God set them apart, gave them a blessing, gave them a new name, [and] registered them in the new Book of the Generations of Adam.”<sup>47</sup>

In light of what scripture tells us, how do we account for the results of genetic studies indicating that every person who has ever lived on earth is descended from a common population of, perhaps, 10,000 founders who lived 100,000 to 150,000 years ago — long before Adam and Eve entered mortality?<sup>48</sup> Drawing on the richer



Fernand-Anne Piestre (Cormon), 1845-1924, *Cain*, Based on Victor Hugo's Poem, 1880

sources of scripture produced through modern revelation, Nibley raises a series of questions with an eye to finding scriptural support for surviving non-Adamic and non-Noachian lineages that might help explain such findings:

What about those people who lived before Cain and Abel?<sup>49</sup> What about those who disappeared from sight?<sup>50</sup> What about those who were not even warned of the Flood?<sup>51</sup> ... What about the comings and goings of Enoch's day between the worlds?<sup>52</sup> Who were his people ... ?<sup>53</sup> ... What about the creatures we do not see around us?<sup>54</sup>

Speaking of Noah, ... "the Lord said: Blessed is he through whose seed Messiah shall come."<sup>55</sup> Methuselah boasted about his line as something special.<sup>56</sup> Why special if it included the whole human race? These blessings have no meaning if all the people of the earth and all the nations are the seed of Noah and Enoch. What other line could the Messiah come through? Well, there were humans who were not invited by Enoch's preaching.<sup>57</sup>

Nibley no doubt was wondering whether some of these shadowy peoples described in scripture might be neither descendants of Noah nor of Adam but rather distantly related contemporaries whose descendants may have mixed at various times with the Adamic lineage.<sup>58</sup> Of relevance is the reminder by Ryan Parr that promised blessings from patriarchs such as Abraham, Isaac, and Jacob are of necessity driven by covenant and lineal descent, not by genetics, since specific "nuclear DNA finding its way from any one of these progenitors to any descendant of today is extremely unlikely from a biological perspective."<sup>59</sup> Happily, the promises made to the faithful covenant posterity are not about inheriting fragments of Abrahamic DNA but rather about receiving a fulness of Abrahamic blessings, assured through faithfulness. Otherwise, the doctrines that describe the possibility of adoption into the Abrahamic lineage would be meaningless.<sup>60</sup>

I am humbled as I read the first chapters of Genesis and the book of Moses and contemplate the vastness, comprehensiveness, and wonder of God's plan for all His



creatures. It is too grand for the human mind to grasp, but not too great for God. Elder Neal A. Maxwell frequently referred to what we might call “God’s greatest understatement.” He spoke of the fact that “in two adjoining verses, the Lord said tersely, ‘I am able to do mine own work.’”<sup>61</sup> Then he commented: “Brothers and sisters, that is about as nice a way as God could say to us that He can handle it!”<sup>62</sup>



Thomas Cole, 1801-1848, *The Subsiding Waters of the Deluge*, 1829

## **Lesson 2: Scripture is a product of a particular point of view.**

Nibley illustrates this idea:<sup>63</sup>

The Latter-day Saints, [like other Bible readers,] are constantly converting statements of limited application to universal or at least sweeping generalities. To illustrate, I was told as a child that the Rocky Mountains, the Appalachians, and the Andes all came into existence overnight during the great upheavals of nature that took place at the time of the Crucifixion — an absurdity that plays into the hands of critics of the Book of Mormon. But what we find in the [Third] Nephi account when we read it carefully is a few sober, factual, eyewitness reports describing an earthquake of 8-plus on the Richter scale in a very limited area. Things that appear unlikely, impossible, or paradoxical from one point of view often make perfectly good sense from another.

The *Nautical Almanac* gives the exact time of sunrise and sunset for every time of the year, yet astronauts know that the sun neither rises nor sets except from a particular point of view, the time of the event being strictly dependent on the exact location. From that point of view and that only, it is strictly correct and scientific to say that the sun does rise and set. Just so, the apparently strange and extravagant phenomena described in the scriptures are often correct descriptions of what would have appeared to a person in a particular situation. ...

So with Noah in the Ark. From where he was, “the whole earth”<sup>64</sup> was covered with water as far as he could see. ... But what were conditions in other parts of the world? If Noah knew that, he would not have sent forth messenger birds to explore.

But doesn’t Genesis 7:19 say that “the waters prevailed exceedingly upon the earth; and all the high hills, that were under the whole heaven, were covered”? Explaining his understanding of this verse, Walter Bradley observes:<sup>65</sup>

The Hebrew word *eretz* used in Genesis 7:19 is usually translated “earth” or “world” but does not generally refer to the entire planet. Depending on the context, it is often translated “country” or “land” to make this clear. ... [For example, i]n Genesis 12:1, Abram was told to leave his *eretz*. He was obviously not told to leave the planet but rather to leave his country. ... [Another] comparison to obtain a proper interpretation of Genesis 7:19 involves Deuteronomy 2:25, which talks about all the nations “under the heavens” being fearful of the Israelites. Obviously, all nations “under the heavens” was not intended to mean all on planet Earth.

Elder John A. Widtsoe, writing in 1943, summed up the important idea of taking point of view into account when interpreting scripture:<sup>66</sup>

We should remember that when inspired writers deal with historical incidents they relate that which they have seen or that which may have been told them, unless indeed the past is opened to them by revelation.

[For example, t]he details in the story of the Flood are undoubtedly drawn from the experiences of the writer. ... The writer of Genesis made a faithful report of the facts known to him concerning the Flood. In other localities the depth of the water might have been more or less.

An additional area where point-of-view comes into prominent play is in consideration of the authorship of the Old Testament. An impressive array of evidences for the seeming heterogeneity of sources within the first five books of the Bible have converged to form the basis of the Documentary Hypothesis, which tries to sort out different sources of authorship in the Old Testament.<sup>67</sup> However, even those who find the Documentary Hypothesis — or some variant of it<sup>68</sup> — compelling have good reason to admire the resulting literary product on its own terms. For example, in the case of the two Creation chapters, Richard Friedman, perhaps the most well-known popular expositor of the Documentary Hypothesis, concludes admiringly that in the scriptural version of Genesis we have a text “that is greater than the sum of its parts.”<sup>69</sup> Sailhamer aptly summarizes the situation when he writes that “Genesis is characterized by both an easily discernible unity and a noticeable lack of uniformity.”<sup>70</sup>

The idea that a series of individuals may have had a hand in the authorship and redaction of the Old Testament should not be foreign to readers of the Book of Mormon, where inspired editors have explicitly described the process by which they wove separate, overlapping records into the finished scriptural narrative. The authors and editors of the Book of Mormon knew that the account was preserved





Joseph Brickey, 1973-: *Lehi Studying the Brass Plates*, 2005

not only for the people of their own times, but also for future generations,<sup>71</sup> including our own.<sup>72</sup>

With this understanding in mind, it should not be disturbing to Latter-day Saint readers that events such as the story of the Flood, in the form we have it today, might be read not only as an actual occurrence but also “as a kind of parable”<sup>73</sup> — its account of the historical events shaped with specific pedagogical purposes in mind. “If this is so,” writes Blenkinsopp, “it would be only one of several examples in P [one of the presumed sources of the Genesis account] of a paradigmatic interpretation of events recorded in the earlier sources with reference to the contemporary situation.”<sup>74</sup> More simply put, Nephi plainly declared: “I did liken all scriptures unto us, that it might be for our profit and learning.”<sup>75</sup> Indeed, Nephi left us with significant examples where he deliberately shaped his explanation of Bible stories and teachings in order to help his hearers understand how they applied to their own situation.<sup>76</sup>

Of course, in contrast to the carefully controlled prophetic redaction of the Book of Mormon, we do not know how much of the editing of the Old Testament may have taken place with less inspiration and authority.<sup>77</sup> Joseph Smith is remembered as saying: “I believe the Bible as it read when it came from the pen of the original writers. Ignorant translators, careless transcribers, or designing and corrupt priests have committed many errors.”<sup>78</sup>



*Joseph Smith, Prophet and Seer, 2011*

**Lesson 3: *It is profitable to read these chapters “literally,” though not in the way people usually think about the word.***

The Prophet Joseph Smith held the view that scripture should be “understood precisely as it reads.”<sup>79</sup> It must be realized, however, that what premoderns understood to be “literal” interpretations of scripture are not the same as what most people understand them to be in our day. Whereas modernists<sup>80</sup> typically apply the term “literal” to accounts that provide clinical accuracy in the journalistic dimensions of who, what, when, and where, premoderns were more apt to understand “literal” in the sense of “what the letters, i.e., the words say.” These are two very different modes of interpretation. As James Faulconer observed: “‘What x *says*’ [i.e., the premodern idea of “literal”] and ‘what x *describes accurately*’ [i.e., the modernist idea of “literal”] do not mean the same, even if the first is a description.”<sup>81</sup>

Consider, for example, Joseph Smith’s description of the Book of Mormon translation process. An emphasis consistent with modernist interests appears in the detailed descriptions given by some of the Prophet’s contemporaries of the size and appearance of the instruments used and the procedure by which the words of the ancient text were made known to him. These kinds of accounts appeal to us as modernists — the more physical details the better — because we want to know what “actually happened” as he translated. Note, however, that Joseph Smith declined to relate such specifics himself even in response to direct questioning in private company from believing friends.<sup>82</sup> The only explicit statement he made about the translation process is his testimony that it occurred “by the gift and power of God,”<sup>83</sup> a description that avoids reinforcing the misleading impression that we can come to an understanding of “what really happened” through “objective” accounts of external observers. Of course, there is no reason to throw doubt on the idea

that the translation process relied on instruments and procedures such as those described by Joseph Smith's contemporaries. However, by restricting his description to the statement that the translation occurred "by the gift and power of God," the Prophet disclaimed the futile effort to make these sacred events intelligible to the modernist literalist. Instead he pointed our attention to what mattered most: that the translation was accomplished by divine means.<sup>84</sup>

James E. Faulconer argues that insistence on a "literal" interpretation of such sacred events, in the contemporary clinical sense of the term, may result in "rob[bing that event] of its status as a way of understanding the world."<sup>85</sup> Elaborating more fully on the limitations of modernist descriptions of scriptural events, he observes that the interest of premoderns.<sup>86</sup>

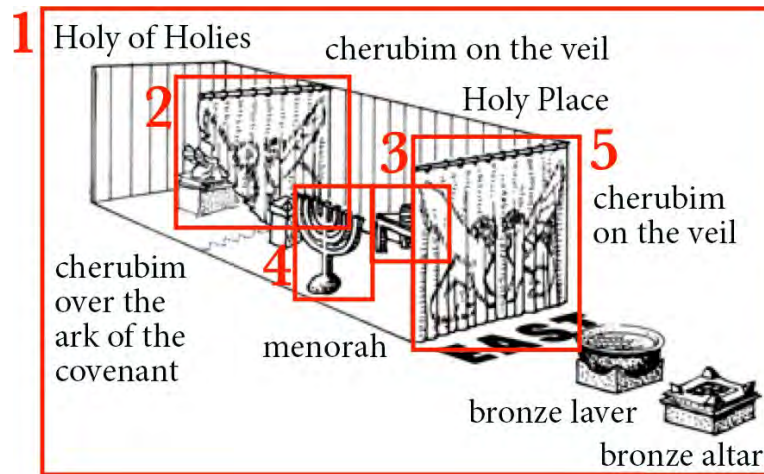
was not in deciding what the scriptures *portray*, but in what they *say*. They do not take the scriptures to be picturing something for us, but to be telling us the truth of the world, of its things, its events, and its people, a truth that cannot be told apart from its situation in a divine, symbolic ordering.<sup>87</sup>

Of course, that is not to deny that the scriptures tell about events that actually happened. ... However, premodern interpreters do not think it sufficient (or possible) to portray the real events of real history without letting us see them in the light of that which gives them their significance — their reality, the enactment of which they are a part — as history, namely the symbolic order that they incarnate. Without that light, portrayals cannot be accurate. A bare description of the physical movements of certain persons at a certain time is not history (assuming that such bare descriptions are even possible).

"Person A raised his left hand, turning it clockwise so that .03 milliliters of a liquid poured from a vial in that hand into a receptacle situated midway between A and B" does not mean the same as "Henry poured poison in to Richard's cup." Only the latter could be a historical claim (and even the former is no bare description).

Of course, none of this should be taken as implying that precise times, locations, and dimensions are unimportant to the stories of scripture. Indeed, details given in Genesis about, for example, the size of the Ark, the place where it landed, and the date of its debarkation are crucial to its interpretation. However, when such details are present, we can usually be sure that they are not meant merely to add a touch of realism to the account but rather to help the reader make mental associations with scriptural stories and religious concepts found elsewhere in the Bible.

In the case of Noah, for example, these associations might echo the story of Creation or might anticipate the Tabernacle of Moses. It is precisely such backward and forward reverberations of common themes in disparate passages of scripture, rather than a photorealistic rendering of the Flood, that will provide the understanding of these stories that we seek. Though we can no more reconstruct the story of Noah from the geology of flood remains than we can re-create the discourse of Abinadi from the ruins of Mesoamerican buildings, we are fortunate to have a scriptural record that can be "understood precisely as it reads."<sup>88</sup>



Michael P. Lyon, 1952-: *Sacred Topography of Eden and the Temple*, 1994 (detail)

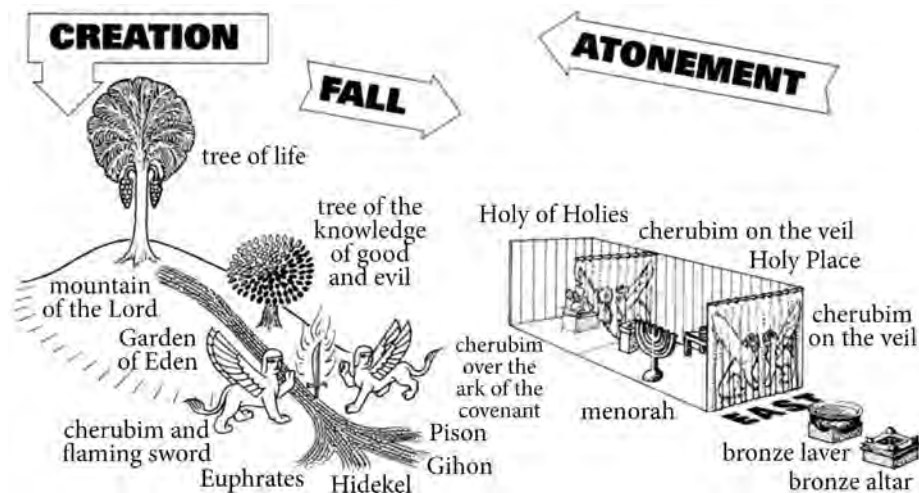
**Lesson 4: *There is a deep relationship between Genesis 1-11 and the liturgy and layout of temples.***

The companion accounts of Creation in Genesis and the book of Moses provide a structure and a vocabulary that seem deliberately designed to highlight temple themes. Louis Ginzberg's reconstruction of ancient Jewish sources is consistent with this overall idea,<sup>89</sup> as well as with the proposal that Genesis 1 may have been used as part of Israelite temple liturgy:<sup>90</sup>

God told the angels: On the first day of creation, I shall make the heavens and stretch them out; so will Israel raise up the tabernacle as the dwelling place of my Glory.<sup>91</sup> On the second day I shall put a division between the terrestrial waters and the heavenly waters, so will [my servant Moses] hang up a veil in the tabernacle to divide the Holy Place and the Most Holy.<sup>92</sup> On the third day I shall make the earth to put forth grass and herbs; so will he, in obedience to my commands, ... prepare shewbread before me.<sup>93</sup> On the fourth day I shall make the luminaries;<sup>94</sup> so he will stretch out a golden candlestick [menorah] before me.<sup>95</sup> On the fifth day I shall create the birds; so he will fashion the cherubim with outstretched wings.<sup>96</sup> On the sixth day I shall create man; so will Israel set aside a man from the sons of Aaron as high priest for my service.<sup>97</sup>

Carrying this idea forward to a later epoch, Exodus 40:33 describes how Moses completed the Tabernacle. The Hebrew text exactly parallels the account of how God finished Creation.<sup>98</sup> *Genesis Rabbah* comments: "It is as if, on that day [i.e., the day the Tabernacle was raised in the wilderness], I actually created the world."<sup>99</sup>

A number of scholars have found parallels in the layout of the Garden of Eden and that of Israelite sanctuaries.<sup>100</sup> To appreciate how the stories told in the book of Moses relate to the temple, one must first understand how the layout of the Garden of Eden parallels that of Israelite temples. Each major feature of the Garden (e.g., the river, the cherubim, the Tree of Knowledge, the Tree of Life) corresponds to a similar symbol in the Israelite temple (e.g., the bronze laver, the cherubim, the veil,<sup>101</sup> the menorah<sup>102</sup>).



Michael P. Lyon, 1952-: *Sacred Topography of Eden and the Temple*, 1994

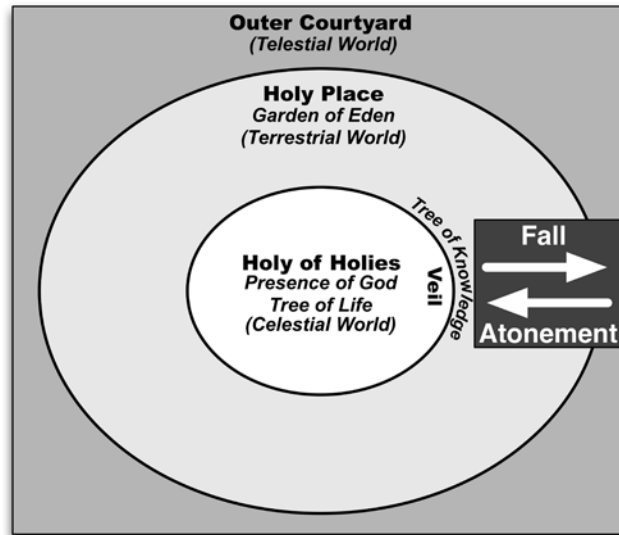
Moreover, the course taken by the Israelite high priest through the temple can be seen as symbolizing the journey of the Fall of Adam and Eve in reverse. In other words, just as the route of Adam and Eve's departure from Eden led them *eastward* past the cherubim with the flaming swords and out of the sacred garden into the mortal world, so in ancient times the high priest would return westward *from* the mortal world, past the consuming fire, the cleansing water, and the woven images of cherubim on the temple veils — and, finally, back into the presence of God. Likewise, in both the book of Moses and the modern LDS temple endowment, the posterity of Adam and Eve trace the footsteps of their first parents — first as they are sent away from Eden, and later in their subsequent journey of return and reunion.<sup>103</sup>

Also recalling the parallels between the layout of the Garden of Eden and Israelite Houses of God, Gary Anderson points out that “the vestments of the priest matched exactly those particular areas of the Temple to which he had access. ... Each time the high priest moved from one gradient of holiness to another, he had to remove one set of clothes and put on another to mark the change”.<sup>104</sup>

- (a) Outside the Tabernacle priests wear ordinary clothes. (b) When on duty in the Tabernacle, they wear four pieces of clothing whose material and quality of workmanship match that of the fabrics found on the outer walls of the courtyard.<sup>105</sup>
- (c) The High Priest wears those four pieces plus four additional ones — these added garments match the fabric of the Holy Chamber where he must go daily to tend the incense altar.

In Eden a similar set of vestments is found, again each set suited to its particular space. (a) Adam and Eve were, at creation, vested like priests and granted access to most of Eden. (b) Had they been found worthy, an even more glorious set of garments would have been theirs (and according to St. Ephrem, they would have entered even holier ground). (c) But having [transgressed], they were stripped of their angelic garments and put on mortal flesh. Thus, when their feet met ordinary earth — the realm of the animals — their constitution had become “fleshly,” or mortal.<sup>106</sup>





*Top-Down View of the Sacred Topography of Eden*

According to Brock, the imagery of clothing in the story of Adam and Eve is “a means of linking together in a dynamic fashion the whole of salvation history; it is a means of indicating the interrelatedness between every stage in this continuing working out of divine Providence,” including “the place of each individual Christian’s [ordinances] within the divine economy as a whole.”<sup>107</sup>

Not only the Garden of Eden, but also Noah’s Ark seems to have been “designed as a temple”<sup>108</sup> — more specifically a prefiguration of the Tabernacle, as argued so well by Michael Morales.<sup>109</sup> In fact, a few ancient accounts go so far in promoting the motif of the temple as to describe the Ark not as a floating watercraft but rather as a stationary, land-based place of protection,<sup>110</sup> where Noah and “many other people” from his generation “hid in a bright cloud” of glory.<sup>111</sup>



*Enoch Window, Ancestors of Christ Windows, Canterbury Cathedral, ca 1178-1180*

The Ark’s three decks suggest both the three divisions of the Tabernacle and the threefold layout of the Garden of Eden.<sup>112</sup> Indeed, each of the decks of Noah’s Ark was exactly “the same height as the Tabernacle and three times the area of the Tabernacle court.”<sup>113</sup> Note that Noah’s Ark is shaped, not as a typical boat, but with a flat bottom like a box or coffer. The ratio of the width to the height of both Noah’s Ark and the Ark of the Covenant is 3:5.<sup>114</sup>

The story of Enoch is also fraught with temple themes.<sup>115</sup> Enoch is shown here with upraised hands in the traditional attitude of prayer. The right hand of God emerges from the cloud to grasp the right wrist of Enoch and lift him to heaven. Having mastered the law of consecration, which is “the consummation of the laws of obedience and



Mario Larrinaga, 1895-1972, *The Hanging Gardens of Babylon (Tower of Babel in the Distance)*, 1959-1962

sacrifice, ... the threshold of the celestial kingdom, [and] the last and hardest requirement made of men in this life,”<sup>116</sup> Enoch’s whole city is taken to the bosom of God, the heavenly temple.

A few chapters later we encounter the Tower of Babel, which can be seen as a sort of anti-temple wherein the Babylonians attempt to “make ... a name” for themselves.<sup>117</sup>

What has all this got to do with the topic of this chapter? In short, I would suggest that the kind of knowledge that will help us best understand the first chapters of Genesis and the book of Moses is not scientific or historic knowledge but rather knowledge of ancient and modern temples and temple worship.

Without a firm grasp on the teachings and ordinances of the temple, we will miss the gist of the primeval history. True, we may “race along with the seductively captivating narratives,” feeling that we are “largely grasping what is going on, even if some exotic or minor details are not immediately apparent.”<sup>118</sup> However, this mode of reading scripture — an approach that focuses on an interpretation of the stories only as presentations of historical characters and events — misses the point. Though the authors of scripture “must have actually experienced ... the meaning of ... ‘the sacred world,’” their writings are “not exactly in a manner of a scientific-ethnographic description and report”<sup>119</sup> but rather are composed representationally<sup>120</sup> “as foundations for collective practices and identity.”<sup>121</sup> The characters and events of the stories of Noah, Enoch, and the Tower of Babel, like the story of Adam and Eve, are “incorporated into the sacred world”<sup>122</sup> of rites and ordinances and must be understood accordingly. On the other hand, insight into the meaning of these stories “is obscured by the recontextualization of the tradition in a [merely] ‘historical’ account.”<sup>123</sup>

Does abandoning the primacy of the historical and scientific world in the interpretation of these scriptures mean that we are left with only fantasy in its place? Not according to Elder Douglas L. Callister, who said: “When you enter the temple, you *leave* the world of make-believe.”<sup>124</sup>

**Lesson 5: *There is more in these chapters than meets the eye.***

The more I study the scriptures, the more I have learned to trust them.<sup>125</sup> When I come to a puzzling verse, I do not automatically assume the passage is wrong, because there have been many times that further study has shown me that I was

mistaken in my initial assumptions or conclusions.

I ran into such a problem when David Larsen and I were studying the call of Enoch in the book of Moses,<sup>126</sup> a topic that already had been explored with insight by Stephen Ricks.<sup>127</sup>

Curiously, the closest biblical parallel to the wording of the opening verses of this passage is not to be found in the call of any Old Testament prophet but rather in the New Testament description of events following Jesus' baptism. The detailed resemblances between Moses 6:26-27 and the accounts of the baptism of Jesus seemed an obvious case of borrowing from the Gospels by Joseph Smith. However, as I studied and prayed about the issue, as a result of what I consider to be a process of inspiration, I came across an obscure article by Samuel Zinner.<sup>128</sup>



George Campfield, fl. 1861, *Creation Window*,  
All Saints Church, Selsley, England, 1861

Zinner compares Hebrews 1:5-6 to passages relating to the Father's declaration of the Lord's Sonship at the baptism of Jesus in the *Gospel of the Ebionites* and the *Gospel of the Hebrews*. He also notes that the motifs of "rest" and "reigning" co-occur in these three texts as well as in the Coptic *Gospel of Thomas*.<sup>129</sup> Finally, he argues for a "striking isomorphism" shared between *1 Enoch* and the baptismal allusion in the *Gospel of the Ebionites* in a promise made by Enoch to the righteous: "and a bright light will shine upon you, and the voice of rest you will hear from heaven."<sup>130</sup>

In summary, Zinner argues from these traces in extrabiblical writings that the ideas behind the description of Jesus' baptism in the Gospel "arose in an Enochic matrix." In other words, the verses from Joseph Smith's writings on Enoch that I thought had been derived from the New Testament were thought instead by Zinner to have originated in ancient Enoch traditions that eventually made their way into the New Testament. Hence, the unexpected parallel to Jesus' baptism in the book





J. James Tissot, 1836-1902, *Building the Tower of Babel*, 1856-1902

of Moses account of the calling of Enoch — which in a cursory analysis might have been looked upon as an obvious anachronism — is a passage with plausible Enochic affinities and possible Enochic origins.<sup>131</sup>

More of a puzzle from a scientific perspective is the Tower of Babel story. On the one hand, the details of the Babylonian setting and construction techniques check out quite plausibly, even if the time frame for the story is difficult to pin down definitively. On the other hand, in light of what is known about evolutionary linguistics the story of the confusion of languages at the Tower of Babel seems patently ridiculous.

Building on the leads of Hugh Nibley, Brant Gardner, and other scholars, a credible alternative can be proposed to the idea that the story explains the origin of multiple languages. Instead, we might imagine that the story describes the dissolution of a lingua franca that had enabled cooperative work among the people who came together from throughout the empire to execute the building project.<sup>132</sup> “From such a mixing of people who were attempting to build a [false] temple to the heavens, Yahweh removed some of His believers [e.g., the Jaredites and, at some point, Abram] for His own purposes.”<sup>133</sup>

If we take the “one language” of Genesis 11:1 as being Sumerian, Akkadian, or even Aramaic<sup>134</sup> rather than a supposed universal proto-language, some of the puzzling aspects of the biblical account become more intelligible. “In addition to the local languages of each nation,<sup>135</sup> there existed ‘one language’<sup>136</sup> which made communication possible throughout the world”<sup>137</sup> — or, perhaps more accurately, throughout the land.<sup>138</sup> “Strictly speaking, the biblical text does not refer to

a plurality of languages but to the ‘destruction of language as an instrument of communication.’”<sup>139</sup>

In my years of acquaintance with the book of Genesis and the book of Moses, I have been astonished with the extent to which their words reverberate with the echoes of antiquity found elsewhere in scripture — and, no less significantly, with the deepest truths of my personal experience. Indeed, I would not merely assert that these books hold up well under close examination but rather that, like a fractal whose self-similar patterns become more wondrous upon ever closer inspection, the brilliance of their inspiration shines most impressively under bright light and high magnification: there is glory in the details.<sup>140</sup>

That said, J. D. Pleins reminds us that:<sup>141</sup>

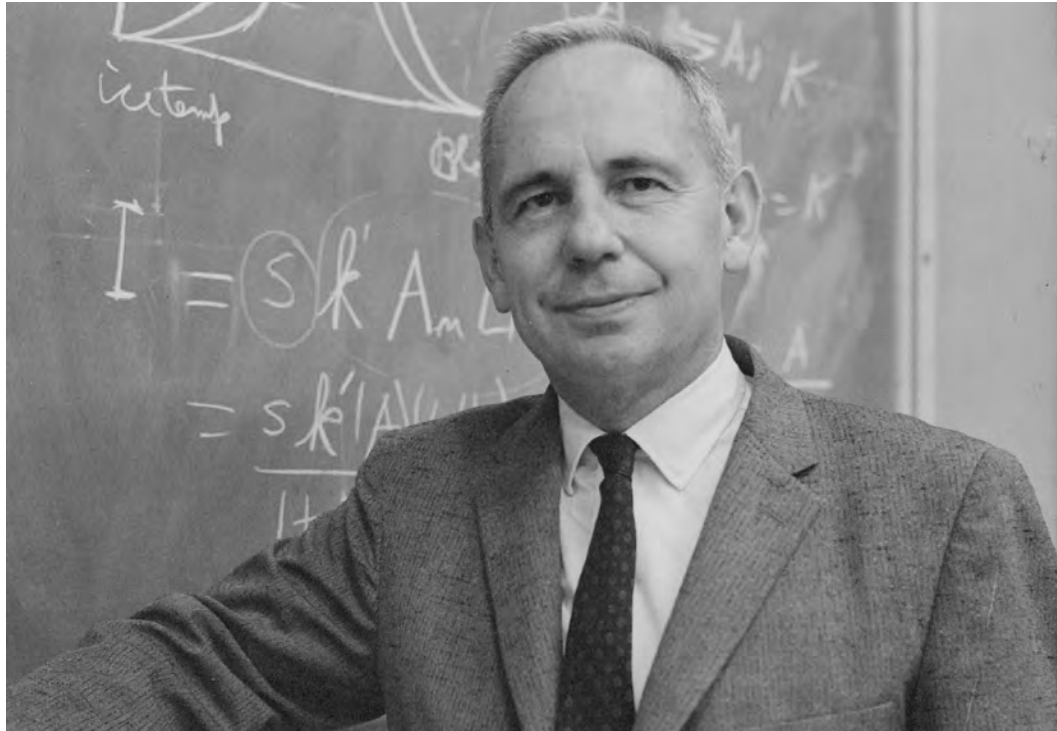
we should acknowledge that not all questions can be answered definitively. This is the nature of the human quest, whether in the realm of science or religion. The answers we have are merely provisional. The search for any final truths is an all-consuming, lifelong task. Faith should not shun the historian’s discoveries, but neither will faith expect the historian to solve all questions. Faith can certainly benefit from seeing in the archaeologist’s persistent probing a kindred spirit in the search for elusive truths. Historical truth is a moving target, not a rock upon which to build faith. Faith, likewise, has its own work to do and cannot wait for the arrival of the latest issue of *Near Eastern Archaeology* before trying to sort things out.

We should avoid the example of the man who found himself in a burning building and said: “I’m not leaving this spot until someone tells me exactly how all this got started.”

### **The Essential Quality of Meekness**

The characteristic of awe mentioned by Carl Sagan — so vital to the pursuit of knowledge in both science and religion — has been equated by Elder Maxwell with the scriptural term “meekness.”<sup>142</sup> Illustrating this attitude of meekness with an anecdote about his scientist father, President Henry B. Eyring wrote:<sup>143</sup>

Some of you have heard me tell of being in a meeting in New York as my father presented a paper at the American Chemical Society. A younger chemist popped up from the audience, interrupted, and said: “Professor Eyring, I’ve heard you on the other side of this question.” Dad laughed and said, “Look, I’ve been on every side of it I can find, and I’ll have to keep trying other sides until I finally get it figured out.” And then he went on with his lecture. So much for looking as though you are always right. He was saying what any good little Mormon boy would say. It was not a personality trait of Henry Eyring. He was a practicing believer in the Lord Jesus Christ. He knew that the Savior was the only perfect chemist. That was the way Dad saw the world and his place in it. He saw himself as a child. He worked his heart out, as hard as he could work. He was willing to believe he didn’t know most things. He was willing to change any idea he’s ever had when he found something which seemed closer to the truth. And even when others praised his



*Henry Eyring (1901-1981) at the Blackboard, 1958.*

work, he always knew it was an approximation in the Lord's eyes, and so he might come at the problem again, from another direction.

Some take the fact that science reverses its positions from time to time as a disturbing thing. On the contrary, I feel that we should take such events as encouraging news. In this regard, I side with those who locate the rationality of science not in the assertion that its theories are erected upon a consistent foundation of irrefutable facts but rather in the idea that it is at heart a self-correcting enterprise.<sup>144</sup> The payload of a mission to Mars precisely hits its landing spot not because we can set its initial course with pinpoint accuracy but rather because we can continue to adjust its trajectory as the rocket advances to its target. The same thing is true with religion — as Paul says, now we see only in part, now we know only in part<sup>145</sup> — that is why we have continuing revelation, and that is why we won't understand some things completely until we meet the Lord face-to-face.

Brother Henry Eyring said that it is the people who can tolerate “no contradictions in their minds [that] may have [the most] trouble.” As for himself, he continued: “There are all kinds of contradictions [in religion] I don't understand, but I find the same kinds of contradictions in science, and I haven't decided to apostatize from science. In the long run, the truth is its own most powerful advocate.”<sup>146</sup>

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### Endnotes

1. Thus Malcolm Muggeridge's poignant question, "Would something like the miracle of Bethlehem even be allowed to happen in our day?" (M. Muggeridge, *Jesus*, p. 19):

In humanistic times like ours, a contemporary virgin ... would regard a message from the Angel Gabriel that she might expect to give birth to a son to be called the Son of the Highest as ill-tidings of great sorrow. ... It is, in point of fact, extremely improbable, under existing conditions, that Jesus would have been permitted to be born at all. Mary's pregnancy, in poor circumstances, and with the father unknown, would have been an obvious case for an abortion; and her talk of having conceived as a result of the intervention of the Holy Ghost would have pointed to the need for psychiatric treatment, and made the case for terminating her pregnancy even stronger. Thus our generation, needing a Savior more, perhaps, than any that has ever existed, would be too humane to allow one to be born; too enlightened to permit the Light of the World to shine in a darkness that grows ever more oppressive.

2. Already in 1905, George Chesterton could write: "Atheism itself is too theological for us today" (G. K. Chesterton, *Heretics*, p. 40). Likewise, Charles Taylor provides an eloquent discussion of the process and consequences of the loss of "immediate certainty" of the moral/spiritual in Western culture (C. Taylor, *Secular Age* — see, e.g., pp. 11ff. See also T. Asad, *Construction*, pp. 47-52). This point is illustrated by Dan Peterson in his discussion of an essay by Jacob Weisberg that views (D. C. Peterson, *Reflections*, pp. xxiii-xxiv. See J. Weisberg, *Romney's Religion*):

reliance upon religious faith in general, not merely Mormonism, 'as an alternative to rational understanding of complex issues.' ... Weisberg regards all religious doctrines as 'dogmatic, irrational, and absurd. By holding them, someone indicates a basic failure to think for himself or see the world as it is.' [Cf. Asad for a view that "the reasons for a person's attachment to a given way of life, or conversion to another, cannot be reduced to an idealized model of scientific theory building" (*ibid.*, p. 235).] More commonly held creeds have simply been granted an unmerited patina of respectability by the sheer passage of time. "Perhaps Christianity and Judaism are merely more venerable and poetic versions of the same. But a few eons makes a big difference."

Peterson also cites a critical review of Bushman's biography of Joseph Smith, which implied that Bushman was overreaching himself in crafting a book that tries to make a place for "both inspiration and rational discourse." Peterson notes the "apparent assumption that rational discourse and inspiration are radically incompatible" and cites the reviewer's declaration "that, in order to earn a secular historian's acceptance, 'Smith's revelations would need to be

explained materially as a product of his cultural or physical environment” (D. C. Peterson, *Reflections* p. xxx. See L. F. Maffly-Kipp, *Who’s That*, p. 11).

Nonmember historian Jan Shipp’s experiences in responding to media questions about Mormonism illustrate the kinds of issues that arise for believers of all faiths in our day (J. Shipp, *Sojourner*, pp. 282-283; cf. R. L. Bushman, *Mormonism*, pp. 113-114):

I remember very well how the voice of one reporter coming across the telephone wire expressed both exasperation and astonishment. “How,” he wailed, “can perfectly sane people believe all this crazy stuff?” Because I had spent the first half of the 1980s writing a book designed to answer that very question, I had a ready reply ... It usually began with my pointing out that the idea that Joseph Smith found golden plates and had revelations was not any more absurd than the idea that Moses and the Hebrews walked across the Red Sea without getting wet or that Jesus, who was dead, is now alive.

That debates about the reality of Jesus’ resurrection are not a new phenomenon of the age of science is emphasized by N. T. Wright, who reminds us: “We didn’t need Galileo and Einstein to tell us that dead people don’t come back to life” (N. T. Wright, *Surprised*, p. 294).

Getting to the nub of the problem, Jacob Neusner concludes that “among our colleagues are some who do not really like religion in its living forms, but find terribly interesting religion in its dead ones. That is why an old Christian text, one from the first century for example, is deemed a worthy subject of scholarship. But a fresh Christian expression (I think in this connection of the Book of Mormon) is available principally for ridicule, but never for study. Religious experience in the third century is fascinating. Religious experience in the twentieth century is frightening or absurd” (J. Neusner, *Vocation*, p. 117).

While not accepting the historicity of the Book of Mormon, non-Mormon scholar Thomas O’Dea is one who at least took the book seriously “as a legitimate work of religious literature” and acknowledged that most of the theories of its origin advanced by its critics were unconvincing (A. L. Mauss, *Near-Nation*, p. 307). He observed with irony that “the Book of Mormon has not been universally considered by its critics as one of those books that must be read in order to have an opinion of it” (T. F. O’Dea, *Mormons*, p. 26).

3. Dickens later spoke admiringly of an uneducated but orderly group of Mormon emigrants he observed in Liverpool, concluding to his own surprise that if he hadn’t have known who they were: “I should have said they were in their degree, the pick and flower of England” (C. Dickens, *Traveler*, 22, 4 July 1863, p. 262). “Dickens related his experience to Richard Monckton Milnes, Lord Houghton, who said that he had himself written on the topic of the Latter-day

Saints in the *Edinburgh Review* in January 1862. In his article Milnes refers to a House of Commons inquiry in 1854 . . . : “The Select Committee of the House of Commons on emigrant ships for 1854 summoned the Mormon agent and passenger-broker before it, and came to the conclusion that no ships under the provisions of the ‘Passengers Act’ could be depended upon for comfort and security in the same degree as those under his administration. . . . [T]he Mormon ship is a Family under a strong and accepted discipline, with every provision for comfort, decorum and internal peace” (P. E. Kerry, Carlyle, pp. 266-267).

Dickens’ contemporaries John Stuart Mill and Thomas Carlyle also wrote sympathetically about the Mormons. In his 1859 essay *On Liberty*, Mill decried “the language of downright persecution which breaks out from the press of this country, whenever it feels called on to notice the remarkable phenomenon of Mormonism.” Characterizing the religion as “the product of palpable imposture,” all the more incredible because of its appearance “in the age of newspapers, railways, and the electric telegraph,” Mill was not at all partial to the teachings of the Church. However, it deeply concerned him that “its prophet and founder was, for his teaching, put to death by a mob; that others of its adherents lost their lives by the same lawless violence; that they were forcibly expelled, in a body, from the country in which they first grew up; while, now that they have been chased into a solitary recess in the midst of a desert, many in this country openly declare that it would be right (only that it is not convenient) to send an expedition against them, and compel them by force to conform to the opinions of other people.” That legitimate means of persuasion could be used to counter its teachings seemed acceptable. “But when the dissentients have conceded to the hostile sentiments of others, far more than could justly be demanded; when they have left the countries to which their doctrines were unacceptable, and established themselves in a remote corner of the earth, which they have been the first to render habitable to human beings; it is difficult to see on what principles but those of tyranny they can be prevented from living there under what laws they please, provided they commit no aggression on other nations, and allow perfect freedom of departure to those who are dissatisfied with their ways” (J. S. Mill, *Liberty*, pp. 163-166).

In the 1854 draft of his *Essay on the Mormons*, Carlyle described Mormonism as “a gross physical form of Calvinism, . . . but in this one point incommensurably (transcendently) superior to all other forms of religion now extant. That it is believed, that it is practically acted upon from day to day and from hour to hour; taken as a very fact, the neglect or contradiction of which will vitiate and ruin all other facts of the day and of the hour. That is its immeasurable superiority” (cited in P. E. Kerry, Carlyle, pp. 266-267, p. 270).

4. Thomas W. Merrill describes the prevailing attitudes of contentious believers and unbelievers as follows (T. W. Merrill, *Children of Skeptics*, pp. 238-239):

In the absence of a more satisfying refutation on the merits, ... published attacks on orthodoxy [have often taken] the form of mockery. Mockery — still a dominant mode of critique of religion among today's avowed atheists — insinuates that religious belief is mere prejudice, mere unthinking habit that has been shed by all forward thinking persons, who cannot help but have contempt or condescending pity for those stick-in-the-mud believers. In turn, those believers cannot help but resent the evident contempt of the intellectuals. Enlightenment thus understood is necessarily divisive: even to this day in all Western democracies, believers and unbelievers confront each other with the haughtiness of contempt on the one side and an understandable resentment on the other.

5. J. Hannay, Smith, p. 385, cited in R. J. Dunn, Dickens, p. 4. A non-LDS observer similarly wrote of the Mormons in 2009: "What would do you do if you met people you admired greatly, who reminded you of the best examples of your fellow believers, yet whose faith rested on what you saw as patent absurdities" W. Lobdell, *Losing*, pp. 121-122). He goes on to concede, however: "Yet what's so strange about Mormonism compared to traditional Christianity. ... The details of Mormonism are fresher, but not much more strange and mythical" (*ibid.*, pp. 126, 127).

Elder Neal A. Maxwell expressed his "special appreciation for my friends who, though resolutely irreligious themselves, were not scoffers. Instead, though doubtless puzzled by me and their other religious friends, they were nevertheless respectful. I admire the day-to-day decency of such men and women. Though detached from theology, their decency is commendable" (N. A. Maxwell, *Inexhaustible*, p. 216). Among the many religious non-Mormon friends is historian Jan Shipps. She put her finger on part of the problem that people encounter in understanding LDS beliefs when she observed that "Mormonism is a really complex theological system. ... All its parts fit together beautifully. But if you just know a little bit about one of them, or part of them, it seems weird" (M. Luo, Test).

For an insightful essay charting the historical evolution of charges that Mormonism is not Christian, see J. Shipps, *Sojourner*, pp. 335-357. For general overviews of changes in public perceptions of the Mormons in America, see T. L. Givens, *Viper*; J. Shipps, *Sojourner*, pp. 51-123).

The well-known Vatican astronomer, Guy Consolmagno, found that two religions were universally dismissed by the subjectively selected sample of scientists and engineers he interviewed as "obviously wrong": Scientology and Mormonism. However, he also notes a difference between the two: "no scientist of my acquaintance has ever had something good to say about Scientology — rather ironic, given its name. But as it happens, I know a number of techies who are Mormons, including my thesis advisor at MIT" (G. Consolmagno, *God's Mechanics*, p. 98). Consolmagno's masters thesis advisor was John S. Lewis, author of a chapter in the present volume, who joined the Church in

Boston while teaching at MIT and, among many other accomplishments, spent time as an internationally-respected professor of planetary science at the University of Arizona.

As one who has experienced both the perplexity and the generosity of spirit of his non-LDS colleagues, prominent Mormon historian Richard L. Bushman shared the following (R. L. Bushman, R. L. Bushman, pp. 79-80):

I have lived an academic life ever since I graduated from Harvard College in 1955 and then later received a Ph.D. in the history of American civilization from that same institution. Since then I have taught at Brigham Young University, Boston University, and the University of Delaware, been visiting professor at Brown and Harvard universities, and now am Gouverneur Morris Professor of History at Columbia University. In these many years as an academic, I have never been belittled for my religious beliefs or felt excluded. I have published books, contributed to conferences, entered into scholarly controversies, and had my share of honors without once feeling that my well-known faith raised a barrier. Only now and then have I caught a glimpse of the wonder my colleagues must feel that a rational, modern man believes the stories and doctrines of the Latter-day Saints. Soon after I was hired as professor of history and chair of the department at the University of Delaware, a member of the search committee invited me to lunch. While we were driving along, I mentioned my work on a biography of Joseph Smith, the founder of the Latter-day Saint Church. My colleague, doubtless to reassure me, turned quickly and said, "Dick, we took all that into account and decided it didn't matter." Apparently he was thinking of the peculiar tic in my intellectual makeup that allowed me to hold these strange beliefs. A similar reaction greeted me on coming to Columbia in 1989. Introduced to a member of the faculty, he said jovially, "Oh, you're the Mormon," an entirely amiable remark meant to make me feel at home. But one can imagine the repercussions if a new faculty member at Brigham Young University was greeted with "Oh, you're the Jew," or "Oh, you're the Catholic."

The extravagant nature of the Latter-day Saint religion probably accounts for the perplexity of my colleagues. Christian and Jewish doctrines, weathered by time, no longer strike people as bizarre or unusual. One can hold to one of the moderate versions of these ancient religions without startling one's friends. But Joseph Smith saw the angel Moroni less than two hundred years ago and then brought home gold plates and translated the Book of Mormon. These miraculous events, happening so close to home, strain one's credulity. How can anyone in this day of science and skepticism believe that God sends angels to speak to humans and requires such unlikely acts as the translation of an ancient history with the aid of a Urim and Thummim? My sophomore tutor, the distinguished historian of science, I. B. Cohen, once coyly mentioned to me that many people thought LDS beliefs were pure garbage. He doubtless was trying gently to bring me to my senses after my sheltered upbringing as a member of the Church.

While Mormons regard many of the doctrinal elaborations that occurred during the early centuries of Christianity as unwarranted intrusions of Greek philosophy into the straightforward historical truths of the Gospel, some non-Mormons see LDS theology merely as simplistic and naïve. For example Thomas Cahill writes that Mormonism resembles Manichaeism in its philosophical impoverishment, being “full of assertions, but [yielding] no intellectual system to nourish a great intellect” (T. Cahill, *Irish*, p. 49). While a strong rebuttal of Cahill’s claim could be buttressed with arguments from a long line of scholars, both Mormon and non-Mormon, who have recognized the unique riches of the LDS tradition, such an argument would distract attention from a more central point: Like all religious traditions with which I am personally acquainted, the primary interest of Mormonism is in developing a universal community of saints not an elite cadre of scholars (see J. E. Faulconer, Tracy; J. Siebach, Response). In his essay on the *Difference between a Genius and an Apostle*, Søren Kierkegaard eloquently captures this distinction between what he calls a “genius” and an “apostle” (S. Kierkegaard, *Purity*, from Translator’s Introduction, p. 21):

The genius, an aristocrat of the spirit, has had gifts lavished upon him by nature that distinguish him from his fellows. The apostle may be a commoner, a fisherman, a one-talent man by nature, or he may have ten talents—yet all that he has is dedicated to the service of the Eternal and as such is lifted up. The genius speaks with brilliance and charm. The apostle speaks with authority. The way of the genius is a way closed to all but a few. The way of the apostle is a way open to all as individuals — even to the genius himself if he can forsake the absorbing satisfactions of a brilliant self-sufficiency and be ready to will one thing.

For a similar point of view, see H. W. Nibley, *Prophets*. See also J. S. Tanner, *Men and Mantles*, pp. 159-160; J. L. Kugel, *How to Read*, pp. 679-689.

6. J. E. Seaich, *Ancient Texts 1995*, p. vii.
7. M. Barker, *Hidden*, p. 34.
8. LaCocque observes: “To consider [such stories as tales] for children is only possible when the story is vaguely known, when it is considered from a distance, and with a preconceived feeling that nothing can be learned from so ‘naïve’ a tale” (A. LaCocque, *Trial*, pp. 10-11).
9. H. W. Nibley, *Before Adam*, p. 63.
10. 1 Corinthians 13:11.
11. Thomas Paine, in his 1794 treatise *The Age of Reason*, dismissed the Flood story in one line by saying: “The story of Eve and the serpent, and of Noah and his Ark, drops to a level with the *Arabian Nights*, without the merit of being entertaining” (J. D. Pleins, *When*, p. 19). Characterizing the view of



contemporary scholarship, Elizabeth Harper observes: “Noah’s Ark still appeals as a colorful children’s toy, but otherwise it is a story much out of favor. It is, after all, historically ridiculous and even morally reprehensible. While it provides a fine example of source divisions for introductory biblical classes, exciting scholarly work seems to lie elsewhere” (E. A. Harper, *It’s All* [2013], p. 32). Cf. Richard Dawkins: “the legend of the animals going into the Ark two by two is charming, but the moral of the story of Noah is appalling” (R. Dawkins, *Delusion*, p. 237).

12. J. David Pleins observes: “Creating a science of the Flood has not necessarily helped to shore up biblical belief. In fact, the preposterous character of so many of the proposals made belief in the Bible seem ludicrous” (J. D. Pleins, *When*, p. 11). Continuing, he writes (*ibid.*, pp. 65-66):

Eating from the fruit of the tree of scientific knowledge has led to a loss of innocence for many believers. The sort of literalism demanded by so many fundamentalists today does not ring true to those who take the geological and evolutionary sciences seriously. Yet is there a place for religion at the table of the sciences? The culture war that creationists are waging has pushed many scientifically minded people away from interest in religion. Many secular scientists join the creationists in thinking that religion and science must ever be in conflict with one another. While rightly wishing to keep creation science out of the biology classroom, those who erect a barrier between modern science and religion run the risk of throwing the baby out with the bath water. Believers in the Bible have not always had a siege mentality when it comes to the sciences. In fact, the popularity of flood geology and creation science serves to conceal the many and varied attempts to bring religious realism and a scientific sensibility to the interpretation of scriptures. Since these more creative efforts, rather than fundamentalism, have dominated the Jewish and Christian centuries, the alternative approaches deserve separate treatment.

13. N. Wyatt, *Water*, p. 219. For a survey of equally dubious modern attempts to create replicas of the Ark, see P. B. Thomas, *Go-4-Wood*.
14. S. Lessin, *Galzu*. Sasha Lessin, who also goes by the name of Alex, claims a PhD in anthropology from UCLA and describes himself as the “Dean of Instruction at Tantra Theosophical and Gaia Worshipping Society of the Divine Human Family.”
15. P. Hall, *Just How Much*. See E. D. Cohen et al., *After Me*, for their analysis of three popular “apocalyptic” films with respect to their embodiment of a “Noahide Apocalyptic Template.” For my views on the film, see J. M. Bradshaw, *Noah Like No Other*.
16. *Noah* (Film).
17. P. Hall, *Just How Much*.

18. Ibid.
19. J. Smith, Jr., *Teachings*, 25 March 1839, p. 137.
20. In a separate chapter of this book, I have provided a discussion of specific questions on verses from Genesis 1-11 and the book of Moses in greater detail. For more on these topics, see J. M. Bradshaw, *God's Image 1*; J. M. Bradshaw and D. J. Larsen, *God's Image 2*.
21. D. Alighieri, *La Divina Commedia*, Inferno: Canto 4:13: *Or discendiam qua giù nel cieco mondo*.
22. The virtuous Roman Virgil, the greatest of poets, served as a guide for Dante in his journeys through the frights of Hell and Purgatory in the *Divine Comedy*. However, because Virgil was unbaptized he could not accompany Dante on his visit to Paradise.
23. R. Dawkins in D. Van Biema, *God vs. Science*, p. 55. As a matter of scientific principle, Dawkins has classed himself as a TAP (Temporary Agnostic in Practice), though he thinks the probability of a God is very small, and certainly in no sense would want to be “misunderstood as endorsing faith” (L. M. Krauss et al., *Science* [online]).
24. L. M. Krauss et al., *Science* (online). Though personally rejecting the notion of a personal God, Albert Einstein is an example of one whose deeply-held “vision of unity and order” (C. H. Townes, *Convergence*, p. 66) — which throughout his life played an important role in shaping his scientific intuitions (see, e.g., W. Isaacson, *Einstein*, p. 335) — was chiefly motivated by his profound sense of awe and humility in the face of the lawful and “marvelously arranged” universe (ibid., p. 388):

Everyone who is seriously involved in the pursuit of science becomes convinced that a spirit is manifest in the laws of the Universe—a spirit vastly superior to that of man, and one in the face of which we with our modest powers must feel humble.

Often more critical of the debunkers of religion than of naïve believers in God, he explained: “The fanatical atheists are like slaves who are still feeling the weight of their chains which they have thrown off after hard struggle. They are creatures who—in their grudge against traditional religion as the ‘opium of the masses’ — cannot hear the music of the spheres” (ibid., p. 390).

25. Cited in N. A. Maxwell, *Cosmos*, p. 1.
26. See J. Smith, Jr., *Teachings*, 25 March 1839, p. 137:

Thy mind, O man! If thou wilt lead a soul unto salvation, must stretch as high as the utmost heavens, and search into and contemplate the darkest abyss, and the broad expanse of eternity—thou must commune with God.

How much more dignified and noble are the thoughts of God, than the vain imaginations of the human heart!

For an insightful discussion of this imperative, see J. W. Welch, *Thy Mind*.

27. Articles of Faith 1:9.

28. For example, in the most recent statement by a standing prophet specifically addressing the origin of man to appear in an official Church publication, President Spencer W. Kimball wrote (Church Educational System, Religion 327, p. 9; S. W. Kimball, *Blessings*, emphasis added):

The Creators breathed into their nostrils the breath of life and man and woman became living souls. We don't know exactly how their coming into this world happened, and *when we're able to understand it the Lord will tell us.*"

29. J. Smith, Jr., *Teachings*, 16 June 1844, p. 374.

30. *Ibid.*, 16 June 1844, p. 374.

31. *Ibid.*, 20 January 1844, p. 331.

32. *Ibid.*, 20 January 1844, p. 331:

But there has been a great difficulty in getting anything into the heads of this generation. It has been like splitting hemlock knots with a corn-dodger [= a hard, fried corn-meal cake] for a wedge, and a pumpkin for a beetle [= a heavy hammer, a maul].

33. R. L. Bushman, *Rough Stone*, p. 200 summarized these difficulties:

"The Vision" confused Mormons who saw only its universalist bent. For most Christians, universal salvation exceeded the limits of acceptable orthodoxy. One Mormon [Brigham Young] reflected later that "my traditions were such, that when the Vision came first to me, it was so directly contrary and opposed to my former education, I said, wait a little; I did not reject it, but I could not understand it" (B. Young, 28 August 1852, p. 31, cited in R. J. Woodford, *Historical Development*, 2:929). Others who were "stumbling at it" did object. At a conference in Geneseo, New York, held to deal with the controversy, one brother declared "the vision was of the Devil & he believed it no more than he believed the devil was crucified" (cited in *ibid.*, 2:930). Ezra Landon was cut off from the Church for insisting "the vision was of the Devil came from hel[l]" (cited in *ibid.*, 2:931). Eventually Joseph counseled missionaries against publicizing "The Vision" prematurely. The first missionaries to England were told to stick to the first principles of the Gospel (J. Smith, Jr., *Documentary History*, 11 June 1837, 2:492). Other members found it thrilling. William Phelps immediately published "The Vision" in the Church newspaper in Missouri (E & MS, vol. 1, no. 2, July 1832, pp. 27-30).

See R. J. Woodford, *Historical Development*, 2:929-933 for a more detailed account of the difficulties of the Saints with this revelation. See also D. Q. Cannon, Section 76, p. 414; B. Young, 18 May 1873, p. 42; M. McBride, *The Vision*. For more on universalism and the revelations of Joseph Smith, see C. P. Griffiths, *Universalism*.

Joseph Smith lamented (J. Smith, Jr., *Teachings*, 21 May 1843, p. 305):

I could explain a hundred fold more than I have of the glories of the kingdoms manifested in the vision, were I permitted, and were the people prepared to receive them. The Lord deals with this people as a tender parent with a child, communicating light and intelligence and the knowledge of His ways as they can bear it.

34. See a nuanced discussion of this issue in M. A. Wright, *Heartland*.
35. Moses 1:33. See also Moses 1:35; D&C 76:24; D&C 88:46-61.
36. The technique that Pisano uses for his engravings is called in French *taille-douce*, literally soft-cutting. Writes N. Pisano, *Prehistoric Engravings* (Unpublished broadside):
 

This is an engraving technique which involves hollowing out a metal-plate (zinc, copper, etc.) by the action of acid after making the drawing with an etcher's needles, burin, aquateinte, etc. After inking, the prints are printed one by one with a hand press. The pressure is very high and allows the paper to pick up the ink from the hollows in the metal. The prints ... are made from one, two, or three plates.
37. For a comprehensive and beautifully illustrated survey of European paleolithic art, see J. Clottes, *L'Art*.
38. The description of how the image was created is drawn from I. Cahn et al., *L'Art*, p. 16.
39. Y. N. Hariri, *Sapiens*, p. 100. As a witness of the great effort and care sometimes made to honor the dead in this era, Hariri notes the 1955 discovery in Sungir, Russia of (*ibid.*, pp. 57-58):

a 30,000 year-old burial site belonging to a mammoth-hunting culture ... [Among other things, i]t contained two skeletons, buried head to head. One belonged to a boy aged about twelve or thirteen, and the other to a girl of about nine or ten. The boy was covered with 5,000 ivory beads. He wore a fox-tooth hat and a belt with 250 fox teeth (at least sixty foxes had to have their teeth pulled to get that many). The girl was adorned with 5,250 ivory beads. Both children were surrounded by stauettes and various ivory objects. A skilled craftsman (or craftswoman) probably needed about forty-five minutes to prepare a single ivory bead. In other words, fashioning the 10,000 ivory beads that covered the two children, not to mention the other

objects, required some 7,500 hours of delicate work, well over three years of labor by an experienced artisan!

40. Free translation of T. Félix et al., *Préhistoire*, pp. 106-107, with additional details provided by R. Teyssedou et al., *Guide de Visite*.
41. See, e.g., H. W. Nibley, *Dominion*.
42. H. W. Nibley, *Before Adam*, pp. 50, 51, 82-83.
43. *Moses* 1:31.
44. J. L. Sorenson, *Ancient*, pp. 50-56.
45. *Moses* 5:12, 16.
46. H. W. Nibley, *Before Adam*, p. 78 and *Moses* 7:33, 37.
47. H. W. Nibley, *Return*, pp. 62-63 and *Moses* 5:5-9; cf. *Revelation* 20:12.
48. For example, F. S. Collins, *Language*, p. 126 writes:

Population geneticists, whose discipline involves the use of mathematical tools to reconstruct the history of populations for animals, plants, or bacteria, look at ... facts about the human genome and conclude that they point to all members of our species having descended from a common set of founders, approximately 10,000 in number, who lived about 100,000 to 150,000 years ago. This information fits well with the fossil record, which in turn places the location of those founding ancestors most likely in East Africa.

Collins (*ibid.*, pp. 125-126) draws out an implication of this finding:

At the DNA level, we are all 99.9 percent identical. That similarity applies regardless of which two individuals from around the world you choose to compare. Thus, by DNA analysis, we humans are truly part of one family. This remarkably low genetic diversity distinguishes us from most other species on the planet, where the DNA diversity is ten or sometimes even fifty times greater than our own. An alien visitor sent here to examine life forms on earth might have many interesting things to say about humankind, but most certainly he would comment on the suprisingly low level of genetic diversity within our species.

Collins is noted for his leadership of the Human Genome Project. Currently, he is director of the National Institutes of Health (NIH). A critic of both Young Earth Creationism and Intelligent Design, he is a proponent of theistic evolution or evolutionary creation, and describes himself as a “serious Christian.” The well-known atheist “Christopher Hitchens referred to Francis Collins as a ‘Great American’ and stated that Collins was one of the most devout believers he had ever met ... [Hitchens said] that their friendship despite their differing opinion on religion was an example of the greatest armed truce in modern times” ([https://en.wikipedia.org/wiki/Francis\\_Collins#Christianity](https://en.wikipedia.org/wiki/Francis_Collins#Christianity) (accessed January 18, 2016))

49. *Moses* 5:12.
50. *Moses* 7:21.
51. *Moses* 7:12, 22.
52. *Moses* 7:27.
53. *Moses* 6:41.

54. It is unclear who Nibley is referring to, unless he is talking about lines of hominids who have become extinct.
55. Moses 7:51-53.
56. Moses 8:2-3.
57. Moses 7:22.
58. J. H. Walton, *Lost World of Adam and Eve*, p. 185 describes such a scenario:

In some models Adam and Eve are thought of as two of the members of a small population of humans and that through the course of time as generation followed generation, their descendants spread through the population and other lines died out such that today everyone has genetic material from these two. This view attempts to place Adam and Eve in Genesis 1 among an *en masse* creation of humans and still retain the idea that Adam and Eve are the parents of us all. It affirms that Adam and Eve were (among) the first humans and that (through a complex process) we are all descended from Adam and Eve. Though it looks nothing like the traditional biblical interpretation, it makes similar affirmations while at the same time accommodating common descent and affirming that the history evident in the genome actually took place.

With reference to a much earlier time than the era of Adam and Eve (no later than approximately 30,000 BCE), there is a growing consensus among researchers that there was a limited amount of interbreeding between the ancestors of today's humans and Neanderthals that led to modern humans carrying 1-4% of Neanderthal genes (Interbreeding?). The authors of one study believe they have "pinpointed the skeletal remains of the first known human-Neanderthal hybrid. ... The finding came from northern Italy, where some 40,000 years ago scientists believe Neanderthals and humans lived near each other, but developed separate and distinctly different cultures" (500,000-Year-Old Neanderthal). Other researchers "suggest that interbreeding went on between the members of several ancient human-like groups living in Europe and Asia more than 30,000 years ago, including an as-yet unknown human ancestor from Asia" (E. Callaway, *Ancient Humans*).

59. R. Parr, *Missing*, pp. 94-97.
60. Of course, the chances that someone on earth today is *not* already a descendant of Abraham are becoming vanishingly slim. See L. Funderburg, *Changing Face* for a vivid photo essay illustrating the rapid growth of multiracial self-identification in America since it was first included in the US Census in 2000.
61. 2 Nephi 27:20, 21.
62. N. A. Maxwell, Richness. In another reference to these verses, Elder Maxwell said: "God's capacity is such that two times in two verses in the Book of

Mormon, He reassures us in a very polite but pointed way, 'I am able to do mine own work' (2 Nephi 27:20–21). Is He ever!" (N. A. Maxwell, *Wondrous*, p. 33).

63. H. W. Nibley, *Before Adam*, pp. 64–66.
64. Genesis 8:9. See J. M. Bradshaw et al., *God's Image 2*, pp. 267–270 for a discussion of evidence pointing to a local (rather than global) Flood.
65. W. Bradley, *Why*, pp. 177–179.
66. J. A. Widtsoe, *Evidences*, p. 127.
67. See, e.g., R. E. Friedman, *Who*; R. E. Friedman, *Hidden*. For a recent LDS perspective on the Documentary Hypothesis and higher criticism in general, see D. E. Bokovoy, *Authoring Genesis-Deuteronomy*. For mixed reviews of the book, see K. L. Barney, *Authoring*; J. M. Bradshaw, *Sorting*.
68. Although broad agreement persists on many issues of longstanding consensus, the state of research on the composition of the Pentateuch continues to evolve in important ways. In 2012, Konrad Schmid gave the following assessment (K. Schmid, *Genesis*, pp. 28–29):

Pentateuchal scholarship has changed dramatically in the last three decades, at least when seen in a global perspective. The confidence of earlier assumptions about the formation of the Pentateuch no longer exists, a situation that might be lamented but that also opens up new and — at least in the view of some scholars — potentially more adequate paths to understand its composition. One of the main results of the new situation is that neither traditional nor newer theories can be taken as the accepted starting point of analysis; rather, they are, at most possible ends.

With respect to Genesis in particular, "it is fairly obvious that the book of Genesis serves as a kind of introduction or prologue to what follows in Exodus through Deuteronomy" (*ibid.*, p. 29). "Nevertheless," continues Schmid in his highlighting of one prominent theme in the most recent thinking on the topic (*ibid.*, pp. 30, 32, 45), "the function of Genesis to the Pentateuch is apparently not exhausted by describing it as an introduction to the Moses story. ... Genesis ... shows ... clear signs of having existed as a stand-alone literary unit for some portion of its literary growth. Genesis is a special book within the Pentateuch: it is the most self-sufficient one. ... In current scholarship, it is no longer possible to explain the composition of the book of Genesis from the outset within the framework of the Documentary Hypothesis." For a broader survey of current research, see J. C. Gertz, *Formation*. For details of textual transmission and reception history of Genesis in Judaism, Christianity, and Islam, see C. A. Evans et al., *Book of Genesis*, pp. 303–632.

69. R. E. Friedman, *Commentary*, p. 16.

70. J. H. Sailhamer, *Genesis*, p. 5.
71. E.g., 2 Nephi 25:8, 21-22; Jacob 1:3; Enos 1:15-16; Jarom 1:2; Mormon 7:1, 8:34-35.
72. E.g., E. T. Benson, *Book of Mormon—Keystone*.
73. J. Blenkinsopp, *The structure of P*, p. 284.
74. *Ibid.*, p. 284.
75. 1 Nephi 19:23.
76. E.g., 1 Nephi 4:2, 17:23-44. André LaCocque describes how the Bible “attributes to historical events (like the Exodus, for instance) a paradigmatic quality” (A. LaCocque, *Captivity of Innocence*, p. 71). “[A]ny conceptual framework which merely purports to reconstruct events ‘as they really were’ (Ranke),” writes Michael Fishbane, “is historicistic, and ignores the thrust of [the Bible’s] reality. For the Bible is more than history. It is a religious document which has transformed memories and records in accordance with various theological concerns” (M. A. Fishbane, *Sacred Center*, p. 6).
77. Cf. B. A. Gardner, *Gift and Power*, p. 295.
78. J. Smith, Jr., *Teachings*, 15 October 1843, p. 327. Cf. 1 Nephi 13:24-28. Willard Richards’ original notes in Joseph Smith’s Diary for this passage read: “I believe the bible, as it ought to be, as it came from the pen of the original writers” (J. Smith, Jr., *Words*, 15 October 1843, p. 256). The notes of Richards, who was present for the original discourse, were later filled out under the direction of Elder George A. Smith who continued the compilation of Joseph Smith’s *History of the Church* after the death of Elder Richards (D. C. Jessee, *JS History*, p. 470). Of course, there are similar difficulties that have come into play in the textual, editing, and publishing history of the Book of Mormon and the Doctrine and Covenants (e.g., Section 27), a fact that should help us better understand the idea of a textual history described by source criticism for the Old Testament. As Ben McGuire explains (B. L. McGuire, 17 March 2014):

Within the short history of our scripture we see numerous such changes (even with the existence of printing technology) that help us to understand that these changes occur quite naturally — and are not necessarily the results of translational issues or corrupt priests. We can, of course, completely identify the history of some of these changes, we can detail corruptions in the Book of Mormon that have occurred from the original manuscript. We can speculate about the existence of these errors where the original manuscript does not exist, and so on. And the fact that we can talk about [D&C] 27 as a composite work is itself another symptom of the process by which our texts come into existence in a way that doesn’t reflect a single author with a single pen, providing us with the perfect word of God.



79. J. Smith, Jr., *Words*, 29 January 1843, p. 161. By this, I do not think that the Prophet meant that a given passage of scripture can be understood in isolation, apart from the context in which it stands. Rather, for example, when he interpreted a parable, his “key” to “ascertain its meaning” was to “dig up the root,” i.e., to “enquire [as to] the question which drew out the answer” (J. Smith, Jr., *Teachings*, January 1843, pp. 276-277). He was democratic in his desire to have the scriptures unfolded to all, decrying those who supposed that their plain truths were “mystery ... and, therefore, are not to be understood.” He declared that all the Saints could come to an understanding of such things “if [they] will but open [their] eyes, and read with candor” (ibid., December 1835, p. 96).
80. We use the term “modernists” rather than “moderns” to describe those who hold this view of interpretation in order to make it clear that this is not the only contemporary point of view possible. For example, many who would describe their perspective as “postmodern” are critical of the modernist view.

A thumbnail characterization of this modernism controversy is given by Faulconer (J. E. Faulconer, *Study*, pp. 131-132):

One writer has described modernism’s assumption this way: “A constellation of positions (e.g., a rational demand for unity, certainty, universality, and ultimacy) and beliefs (e.g., the belief that words, ideas, and things are distinct entities; the belief that the world represents a fixed object of analysis separated from forms of human discourse and cognitive representation; the belief that culture is subsequent to nature and that society is subsequent to the individual)” (S. Daniel, *Paramodern Strategies*, pp. 42-43). There is far too little room here to discuss the point extensively, but suffice it to say that, first, few, if any, of these assumptions have remained standing in the twentieth century, and second, the failure of these assumptions does not necessarily imply the failure of their claims to truth or knowledge, as is often argued, sometimes by adherents to the current attack on modernism and sometimes by critics of that attack. For an excellent discussion of postmodernism and its relation to religion, see J. Caputo, *Good News*.

81. J. E. Faulconer, *Incarnation*, p. 44, emphasis added.
82. In response to a request in 1831 by his brother Hyrum to explain the translation process more fully, Joseph Smith said that “it was not intended to tell the world all the particulars of the coming forth of the Book of Mormon; and ... it was not expedient for him to relate these things” (J. Smith, Jr., *Documentary History*, 25-26 October 1831, 1:220). For more on the Prophet’s reluctance to share details of sacred events, see R. O. Barney, *Joseph Smith’s Visions*; R. Nicholson, *Cowdery Conundrum*.
83. J. Smith, Jr., *Documentary History*, 4 January 1833, 1:315, in a parallel to the wording found in Omni 1:20 that was later taken up in the account and

testimony of the Three Witnesses (J. Smith, Jr. et al., *Histories*, 1832-1844, pp. 318-323). See also D&C 1:29, 20:8.

84. Brant Gardner summarizes (B. A. Gardner, *Gift and Power*, p. 321):

The Book of Mormon was translated by a very human Joseph Smith. Nevertheless, he was a human being inspired to extrahuman ability through divine providence. Joseph declined to say more about the translation of the Book of Mormon than to declare that it was accomplished through “the gift and power of God.” No matter how closely we examine the process, no matter how well we might understand the human aspect, Joseph’s description really remains the best.

85. J. E. Faulconer, *Dorrien*, p. 426.
86. J. E. Faulconer, *Incarnation*, pp. 44-45, emphasis added. Cf. J. E. Faulconer, *Study*, pp. 124-133.
87. Cf. A. G. Zornberg, *Genesis*, pp. 31-32.
88. J. Smith, Jr., *Words*, 29 January 1843, p. 161.
89. L. Ginzberg, *Legends*, 1:51. See also W. P. Brown, *Seven Pillars*, pp. 40-41; P. J. Kearney, *Creation*; C. H. T. Fletcher-Louis, *Cosmology of P*, pp. 10-11. According to J. H. Walton, *Lost World*, p. 82:

the courtyard represented the cosmic spheres outside of the organized cosmos (sea and pillars). The antechamber held the representations of lights and food. The veil separated the heavens and earth — the place of God’s presence from the place of human habitation.

Note that in this conception of creation the focus is not on the origins of the raw materials used to make the universe but rather on their fashioning into a structure providing a useful purpose. The key insight, according to Walton, is that: “people in the ancient world believed that something existed not by virtue of its material proportion, *but by virtue of its having a function in an ordered system*. ... Consequently, something could be manufactured physically but still not ‘exist’ if it has not become functional. ... The ancient world viewed the cosmos more like a company or kingdom” that comes into existence at the moment it is organized, not when the people who participate it were created materially (*ibid.*, pp. 26, 35; cf. J. Smith, Jr., *Teachings*, 5 January 1841, p. 181, Abraham 4:1).

J. H. Walton, *Lost World*, pp. 43-44, 53 continues:

It has long been observed that in the contexts of *bara'* [the Hebrew term translated “create”] no materials for the creative act are ever mentioned, and an investigation of all the passages mentioned above substantiate that claim. How interesting it is that these scholars then draw the conclusion that *bara'* implies creation out of nothing (*ex nihilo*). One can see with

a moment of thought that such a conclusion assumes that “create” is a material activity. To expand their reasoning for clarity’s sake here: Since “create” is a material activity (assumed on their part), and since the contexts never mention the materials used (as demonstrated by the evidence), then the material object must have been brought into existence without using other materials (i.e., out of nothing). But one can see that the whole line of reasoning only works if one can assume that *bara’* is a material activity. In contrast, if, as the analysis of objects presented above suggests, *bara’* is a functional activity, it would be ludicrous to expect that materials are being used in the activity. In other words, the absence of reference to materials, rather than suggesting material creation out of nothing, is better explained as indication that *bara’* is not a material activity but a functional one. ...

In summary, the evidence ... from the Old Testament as well as from the ancient Near East suggests that both defined the pre-creation state in similar terms and as featuring an absence of functions rather than an absence of material. Such information supports the idea that their concept of existence was linked to functionality and that creation was an activity of bringing functionality to a nonfunctional condition rather than bringing material substance to a situation in which matter was absent. The evidence of matter (the waters of the deep in Genesis 1:2) in the precreation state then supports this view.

90. E.g., M. Weinfeld, *Sabbath*, pp. 508-510; S. D. Ricks, *Liturgy*; P. J. Kearney, *Creation*; J. Morrow, *Creation*.
91. Exodus 40:17-19.
92. Exodus 40:20-21.
93. Exodus 12:8, 25:30.
94. For a discussion how the notion of “priestly time” is reflected in the story of the creation of the luminaries, see M. S. Smith, *Priestly Vision*, pp. 93-94, 97-98. If we take a functional view of Creation, then the luminaries are among the functionaries (J. H. Walton, *Lost World*, pp. 63-66).
95. Exodus 25:31-40, 37:17-24.
96. Exodus 25:18-22, 37:6-9.
97. See Exodus 40:12-15. See also M. S. Smith, *Priestly Vision*, pp. 98-102. J. H. Walton, *Lost World*, p. 149 writes:

Through Genesis 1 we come to understand that God has given us a privileged role in the functioning of His cosmic temple. He has tailored the world to our needs, not to His (for He has no needs). It is His place, but it is designed for us and we are in relationship with Him.

See C. H. T. Fletcher-Louis, *Jewish Roots*, p. 128 for the idea that certain individuals (e.g., the high priest, as possessor of the “glory of Adam”) were

even “deemed worthy of worship because they were God’s Image, his living idols.” Cf. S. Bunta, *Likeness*; John 14:6-13.

98. Moses 3:1. Significantly, the view that relates the symbolism of the Creation to the elevation of the Israelite sanctuary is shared by scholars of very different persuasions as to the process of Bible authorship (see, e.g., J. D. Levenson, *Temple and World*, p. 287; A. C. Leder, *Coherence*, p. 267; J. Morrow, *Creation*; D. P. Wright, *Inventing*, p. 509 n. 31; M. S. Smith, *Priestly Vision*; J. H. Walton, *Lost World*; J. H. Walton, *Genesis*, pp. 10-31; W. P. Brown, *Seven Pillars*, pp. 33-77; D. E. Bokovoy, *Authoring Genesis-Deuteronomy*, pp. 147-149). See also J. M. Bradshaw, *God’s Image 1*, pp. 146-149; J. M. Bradshaw, *LDS Book of Enoch*.

Levenson cites Blenkinsopp’s thesis of a triadic structure in the priestly concept of world history that described the “creation of the world,” the “construction of the sanctuary,” and “the establishment of the sanctuary in the land and the distribution of the land among the tribes” in similar, and sometimes identical language. Thus, as N. Polen, *Leviticus*, p. 216 reminds us:

the purpose of the Exodus from Egypt is not so that the Israelites could enter the Promised Land, as many other biblical passages have it. Rather it is theocentric: so that God might abide with Israel. ... This limns a narrative arc whose apogee is reached not in the entry into Canaan at the end of Deuteronomy and the beginning of Joshua, but in the dedication day of the Tabernacle (Leviticus 9-10) when God’s Glory — manifest Presence — makes an eruptive appearance to the people (Leviticus 9:23-24).

In another correspondence, M. S. Smith, *Priestly Vision*, p. 47 notes a variation on the first Hebrew word of Genesis (*bereshit*) and the description used in Ezekiel 45:18 for the first month of a priestly offering (*barishon*):

“Thus said the Lord: ‘In the beginning (month) on the first (day) of the month, you shall take a bull of the herd without blemish, and you shall cleanse the sanctuary.’” What makes this verse particularly relevant for our discussion of *bereshit* is that *ri’shon* occurs in close proximity to *’ehad*, which contextually designates “(day) one” that is “the first day” of the month. This combination of “in the beginning” (*barishon*) with with “(day) one” (*yom ’ehad*) is reminiscent of “in beginning of” (*bereshit*) in Genesis 1:1 and “day one” (*yom ’ehad*) in Genesis 1:5.

Hahn notes the same correspondences to the creation of the cosmos in the building of Solomon’s Temple (S. W. Hahn, *Christ, Kingdom*, pp. 176-177; cf. J. Morrow, *Creation*; J. D. Levenson, *Temple and World*, pp. 283-284; C. H. T. Fletcher-Louis, *Glory*, pp. 62-65; M. Weinfeld, *Sabbath*, pp. 506, 508):

As creation takes seven days, the Temple takes seven years to build (1 Kings 6:38). It is dedicated during the seven-day Feast of Tabernacles (1 Kings 8:2), and Solomon’s solemn dedication speech is built on seven petitions (1 Kings 8:31-53). As God capped creation by “resting” on the seventh day, the Temple is built by a “man of rest” (1 Chronicles 22:9) to be a “house of rest”

for the Ark, the presence of the Lord (1 Chronicles 28:2; 2 Chronicles 6:41; Psalm 132:8, 13-14; Isaiah 66:1).

When the Temple is consecrated, the furnishings of the older Tabernacle are brought inside it. (R. E. Friedman suggests the entire Tabernacle was brought inside). This represents the fact that all the Tabernacle was, the Temple has become. Just as the construction of the Tabernacle of the Sinai covenant had once recapitulated creation, now the Temple of the Davidic covenant recapitulated the same. The Temple is a microcosm of creation, the creation a macro-temple.

99. J. Neusner, *Genesis Rabbah* 1, 3:9, p. 35.
  100. E.g., G. K. Beale, *Temple*, pp. 66-80; G. J. Wenham, *Sanctuary Symbolism*; J. M. Lundquist, *Reality*; D. W. Parry, *Garden*; J. A. Parry et al., *Temple in Heaven*; T. Stordalen, *Echoes*, pp. 112-116, 308-309; R. N. Holzapfel et al., *Father's House*, pp. 17-19; J. Morrow, *Creation*. The imagery of the Garden of Eden as a prototype sanctuary is not incompatible with views that relate the symbolism of the Creation of the cosmos to the temple, as discussed above.
  101. See J. M. Bradshaw, *Tree of Knowledge* for an explanation of how the symbolism of the Tree of Knowledge relates to that of the temple veil.
  102. In most depictions of Jewish temple architecture, the menorah is shown as being *outside* the veil — in contrast to the Tree of Life which is at the holiest place in the Garden of Eden. However, Margaret Barker cites evidence that, in the first temple, a Tree of Life was symbolized *within* the Holy of Holies (e.g., M. Barker, *Hidden*, pp. 6-7; M. Barker, *Christmas*, pp. 85-86, 140; J. M. Bradshaw, *God's Image 1*, pp. 366-367). Barker concludes that the Menorah (or perhaps a second, different, representation in arboreal form?) was both removed from the temple and diminished in stature in later Jewish literature as the result of a "very ancient feud" concerning its significance (M. Barker, *Older*, p. 221}, see pp. 221-232).
- Mandaean scripture describes a Tree of Life within the *heavenly* sanctuary as follows: "They ... lifted the great veil of safety upward before him, introduced him, and showed him that Vine," meaning the Tree of Life (M. Lidzbarski, *Ginza*, GL 1:1, p. 429:3-20; cf. E. S. Drower, *Prayerbook*, 49, pp. 45-46).
103. Cf. John 16:28.
  104. G. A. Anderson, *Perfection*, p. 122.
  105. Exodus 28.
  106. G. A. Anderson, *Perfection*, p. 123.

107. Brock in Ephrem the Syrian, *Paradise*, pp. 66-67. For more detail on the theme of changes of clothing in the story of Adam and Eve, see J. M. Bradshaw, *Moses Temple Themes*, pp. 149-156.
108. C. H. T. Fletcher-Louis, *Glory*, p. 41. See also Wyatt's discussion of the arks of Noah and Moses, the Ark of the Covenant, and the story of Utnapishtim in *Gilgamesh* (N. Wyatt, *Water*, pp. 214-216). For additional discussion, see J. M. Bradshaw and D. J. Larsen, *God's Image 2*, pp. 210-221.
109. L. M. Morales, *Tabernacle Pre-Figured*.
110. See, e.g., Jason Silverman's discussion of the Zoroastrian story of Yima who, after a warning from the god Ahura Mazda, built a four-sided *Vara* ("enclosure") for protection of humans, cattle, dogs, fires, and plants from bad winters and subsequent spring flooding: "The inhabitants of the *Vara* are those who are ritually pure" and the term *vara* normally denotes "an area enclosed for reasons of ritual purity. ... [T]he *Vara* of Yima has three sections, just as the sacred ritual precinct has three grooves that mark it off from the outside world" (J. M. Silverman, *It's a Craft*, p. 207). Silverman goes on to discuss the how the "paradise" of Yima relates to the Persian notion of a walled garden domain, and shows how the *Vara* "functions as a condensation of Zoroastrian eschatological hope — it is a microcosm of the world as it will be *sans* Angra Mainyu's influence" (*ibid.*, p. 210). In this sense, it can be compared with the Jewish idea of a New Jerusalem (*ibid.*, pp. 211-220).
111. M. Meyer, *Secret Book of John*, 29:135-136, p. 130:
 

It did not happen the way that Moses said, "They hid in an ark" (Genesis 7:7). Rather they hid in a particular place, not only Noah but also many other people from the unshakable generation. They entered that place and hid in a bright cloud. Noah knew about his supremacy [alternatively, "he (Noah) recognized his authority" (F. Wisse, *Apocryphon of John*, 29:12, p. 121); or "Noah was aware of his divine calling" (H. W. Nibley, *Enoch*, p. 268)]. With him was the enlightened one who had enlightened them since the first ruler had brought darkness upon the whole earth.
112. J. M. Bradshaw, *Moses Temple Themes*, pp. 77-87. Cf. Ephrem the Syrian, *Paradise*, p. 53; A. S.-M. Ri, *Caverne Syriaque*, p. 208. See the discussion in E. A. Harper, *You Shall Make*, p. 50 concerning readings of Genesis 6:16 in the Targums and the *Septuagint*, and for a description of parallels in 1 Kings 6:6 and Ezekiel 41:7.
113. J. D. G. Dunn et al., *Commentary*, p. 44. In other words, the dimensions of the Tabernacle courtyard have "the same width [as the Ark] but one-third the length and height" (Ronald Hendel in H. W. Attridge et al., *HarperCollins Study Bible*, p. 14 n. 6:14-16). Intriguingly, a cuneiform tablet

from Old Babylonian times describes a Mesopotamian ark that is built on a circular plan (see I. L. Finkel, *Ark Before Noah*, pp. 123-155).

114. See Genesis 6:15 and Exodus 25:10.
115. For more on temple themes in the story of Enoch, see J. M. Bradshaw, LDS Book of Enoch.
116. H. W. Nibley, Foundation, p. 168.
117. See Genesis 11:4. For more on temple themes in the story of the Tower of Babel, see J. M. Bradshaw and D. J. Larsen, *God's Image 2*, pp. 390-396.
118. A. S. Kohav, *Sôd Hypothesis*, p. 48.
119. Ibid., p. 48.
120. While not intending to affirm the validity of all the specific results of Kohav's dissertation research, we note his interesting hypothesis that the compilers of the Hexateuch deliberately coded their primary message in a way that would be deliberately misunderstood by readers unfamiliar with their methods and intentions relating to the preservation of the "First Temple priestly initiation tradition" (ibid., back cover):

The thesis foregrounds a "second-channel" esoteric narrative from within the Pentateuch and the book of Joshua [that was] a successful if drastic priestly means of preserving the secrecy and ultimate survival of their respective esoteric and initiatory doctrines and methods.
121. R. S. Hendel, Cultural Memory, p. 28.
122. D. E. Callender, *Adam*, p. 211.
123. Ibid., p. 212. Cf. J. H. Sailhamer, *Meaning*, pp. 140-148. J. David Pleins criticizes what he calls "loose literalism" for the way it allows the historical and the archaeological to push aside the value of what the scripture actually says (J. D. Pleins, *When*, p. 18):

The trouble with loose literalism is that what tends to capture our attention is the clever explanation rather than the story itself. We quickly move on from the Flood story ... to the seemingly more interesting archaeological problems that stand back of the Bible.

We catch Ryan and Pitman falling into this trap in a section of [their book on Noah's Flood] that extols the virtue and power of ancient myth:

For a myth to survive unscathed from repeated recitation, it needs a powerful story. ... Oral tradition tells such stories. But so does the decipherment by the natural scientist who works from a text recorded in layers of mud, sand, and gravel from the bottom of lakes and seas using all the tools and principles of physics,

chemistry, and biology. The scientific plot can then be given richer detail and new themes from the supporting contributions of the archaeologist, the linguist, and the geneticist.

Figures such as Noah and the Mesopotamian survivor of the Flood, Utnapishtim, are thus relegated to the supporting cast in a grander scientific drama that has as its dramatis personae scores of dislocated village dwellers put on the move by a Neolithic conflagration.

- 124 Emphasis added. From notes of a talk given by Sister Sheri L. Dew, who spoke at a broadcast for the Southeast US Area YSA conference, 9-11 August 2013. She reported this comment as having been made at a meeting of young people at the Bountiful Temple, where Elder Callister was then serving as a temple president. Cf. H. W. Nibley, *Sacred*, p. 604 (and see pp. 604-615 generally):

When we enter the temple, we leave one world and step into another. Conversely, when we leave the temple, we leave one world, sometimes with a sigh of relief, and return to the other. If the Latter-day Saints are going to continue building temples, they must make up their minds as to which world they are going to live in. It should not be hard to decide if only we are willing.

- 125 As a result of his experiences, Faulconer gives the following guidance to scripture readers (J. E. Faulconer, *Study*, pp. 11-12):

Assume that the scriptures mean exactly what they say and, more important, assume that we do not already know what they say. If we assume that we already know what the scriptures say, then they cannot continue to teach us. If we assume that they mean something other than what they say, then we run the risk of substituting our own thoughts for what we read rather than learning what they have to teach us. ... [A]ssume that each aspect of whatever passage we are looking at is significant and ask about that significance. To assume that some things are significant and others are not is to assume, from the beginning, that we already know what scripture means. Some things may turn out to be irrelevant, but we cannot know that until we are done.

Similarly, Wright comments that if you read in this way (N. T. Wright, *Authoritative*):

the Bible will not let you down. You will be paying attention to it; you won't be sitting in judgment over it. But you won't come with a preconceived notion of what this or that passage has to mean if it is to be true. You will discover that God is speaking new truth through it. I take it as a method in my biblical studies that if I turn a corner and find myself saying, "Well, in that case, that verse is wrong" that I must have turned a wrong corner somewhere. But that does not mean that I impose what I think is right on to that bit of the Bible. It means, instead, that I am forced to live with that text uncomfortably, sometimes literally for years (this is sober autobiography), until suddenly I come round a different corner and that verse makes a lot of



sense; sense that I wouldn't have got if I had insisted on imposing my initial view on it from day one.

By way of contrast, J. L. Kugel, *How to Read*, p. 666 notes the “subtle shift in tone” that has come with “the emphasis on reading the Bible [solely] in human terms and in its historical context” without the counterbalance provided by traditional forms of scripture reading:

As modern biblical scholarship gained momentum, studying the Bible itself was joined with, and eventually overshadowed by, studying the historical reality behind the text (including how the text itself came to be). In the process, learning from the Bible gradually turned into learning about it. Such a shift might seem slight at first, but ultimately it changed a great deal. The person who seeks to learn from the Bible is smaller than the text; he crouches at its feet, waiting for its instruction or insights. Learning about the text generates the opposite posture. The text moves from subject to object; it no longer speaks but is spoken about, analyzed, and acted upon. The insights are now all the reader's, not the text's, and anyone can see the results. This difference in tone, as much as any specific insight or theory, is what has created the great gap between the Bible of ancient interpreters and that of modern scholars.

126. Moses 6:26-36.
127. S. D. Ricks, Narrative Call.
128. S. Zinner, Underemphasized parallels.
129. H. Koester et al., Thomas, 2, p. 126.
130. G. W. E. Nickelsburg, *1 Enoch* 1, 96:3, p. 461. Cf. Ibid., 91:1, p. 409, which speaks of “a voice calling me, and a spirit poured out upon me.” Relating to the theme of reigning. Zinner also notes *1 Enoch* 96:1, which speaks of the “authority” that the “righteous” will have over the “sinners” (ibid., 96:1, p. 461).
131. E.g., G. W. E. Nickelsburg et al., *1 Enoch* (2012), 71:14-16, p. 321.
132. A. George, Stele of Nebuchadnezzar II, p. 160. On the idea that such mixing of peoples was being condemned in the Tower of Babel story, see J. M. Bradshaw et al., *God's Image* 2, p. 400.
133. B. A. Gardner, Second Witness, 6:165.
134. Aramaic would presume a setting for the story no earlier than the beginning of the first millennium BCE.
135. Genesis 10:5, 20, 31.

136. Genesis 11:1, 6. It may be significant that the JST for these verses reads: “*the same language*,” not “*one language*.”
137. V. P. Hamilton, *Genesis 1-17*, p. 350.
138. See J. M. Bradshaw et al., *God’s Image 2*, p. 428.
139. A. LaCocque, *Captivity of Innocence*, p. 66, citing Paul Ricoeur.
140. The way in which the glory of God’s work is ultimately revealed in the simple details of sacred texts, divinely influenced events, and the acts of godly persons is brilliantly described by Chesterton (G. K. Chesterton, *William Blake*, p. 210):

The wise man will follow a star, low and large and fierce in the heavens; but the nearer he comes to it the smaller and smaller it will grow, till he finds it the humble lantern over some little inn or stable. Not till we know the high things shall we know how lowly they are. Meanwhile, the modern superior transcendentalist will find the facts of eternity incredible because they are so solid; he will not recognize heaven because it is so like the earth.
141. J. D. Pleins, *When*, p. 168.
142. N. A. Maxwell, *Disciple-Scholar*, pp. 14-18. Indeed, it is because of the limits of our knowledge that we court danger when we try to effect a premature reconciliation of scientific and religious issues. B. Kent Harrison, former Professor of Physics and Astronomy at BYU, wisely wrote (B. K. Harrison, *Truth*, pp. 153-154):

Some disagreements [between science and religion] are inevitable because our knowledge is incomplete. But we believe in a unified truth and so we eventually expect agreement. It is tempting to seek agreement now. *However, it is inappropriate, and often dangerous, to attempt a premature reconciliation or conflicting ideas where there is a lack of complete knowledge.* If a scientist concludes that there is no God — based on inadequate evidence! — and thereby casts doubt on those who believe in God, he does them a disservice. For example, it is inappropriate for a scientist who accepts organic evolution to claim that there is no God. (However, many scientists do indeed take the position that they cannot comment on religious truth because they have little or no information on it.)

Similarly, if an ecclesiastic states that such and such a scientific idea is not true — based on inadequate evidence! — then he does a disservice to the scientist who has carefully explored that idea. As a hypothetical example, it would be inappropriate for a church authority to make a flat statement that special relativity is invalid because it limits information transmission such as prayer to the very slow (!) speed of electromagnetic waves. It may later turn out to be invalid in some sense, but current experimental and other considerations support it strongly.

*The proper stance, it seems, is to withhold judgment on such questions until we have more information — but also to take advantage of what knowledge we do have.*

An example where reconciliation of scientific and religious issues seems premature is the concern of some that the idea of man being created in the image of God — while an exalting concept to man — would be limiting to God to the extent one considers the human form to be finite and imperfect.

Thus, thoughtful believers might feel inclined to wonder whether the “sense in which the Father’s body is like a human body must be qualified” (B. Ostler, *Attributes*, p. 352). Moreover, it must be remembered that “Latter-day Saints affirm only that the Father has a body [D&C 130:22], not that His body has Him” (C. L. Blomberg et al., *Divide*, p. 88). To what extent might God Himself transcend His bodily form, just as man is more than mortal flesh? Though having appeared to prophets in glorified, corporeal form, would it be unreasonable to infer that God must somehow be capable of transcending fundamental limitations of human understanding deriving from the finite nature of physical senses and measures, the unimaginable scale of what would need to be known, and — if that were not enough — the fact that a perfect knowledge of the state of things seems precluded by the laws of quantum physics themselves? (See J. M. Bradshaw, *God’s Image 1*, Excursus 7: Time and Eternity, p. 537 for a brief overview of philosophical and scientific issues bearing on such questions.)

Moreover, the fact that the existence of God transcends the birth and death of universes attests to the truth that our own identities, being possessed of a similar eternal nature, will also survive the presumed winding-down of our present universe. It also seems evident that our experience of “time” will be different in eternity than in mortality. Elder Neal A. Maxwell concluded: “God does not live in the dimension of time as do we [Alma 40:8; D&C 130:7]. We are not only hampered by our finiteness (experiential and intellectual), but also by being in the dimension of time. Moreover, God, since ‘all things are present’ with Him [Moses 1:6], is not simply predicting based solely on the past. In ways that are not clear to us, he sees rather than foresees the future, because all things are at once present before him” (N. A. Maxwell, *Things*, p. 29).

143. H. B. Eyring, *Faith*, p. 70.
144. G. Bateson, *Mind*, p. 216; G. Bateson et al., *Angels*, pp. 36-49; W. Weimer, *Notes*, pp. 47-49.
145. See 1 Corinthians 13:12: “For now we see through a glass, darkly; but then face to face: now I know in part; but then shall I know even as also I am known.”
146. H. Eyring, *Reflections*, p. 47.

# FREQUENTLY ASKED QUESTIONS ABOUT SCIENCE AND GENESIS

Jeffrey M. Bradshaw

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**A**s counsel to anyone engaged in well-intentioned but misguided efforts to infer science facts from their readings of Genesis, Elder James E. Talmage wrote the following:<sup>1</sup>

The opening chapters of Genesis, and scriptures related thereto, were never intended as a textbook of geology, archaeology, earth-science or man-science. Holy Scripture will endure, while the conceptions of men change with new discoveries. We do not show reverence for the scriptures when we misapply them through faulty interpretation.<sup>2</sup>

In this chapter, I will explore passages in the first eleven chapters of Genesis and the book of Moses that are sometimes seen falsely as presenting opposing alternatives to the findings of modern science. The first part of the chapter will discuss the book of Genesis as a whole, while the second part will answer questions about specific verses of interest.

### **Questions about the Book of Genesis as a Whole**

#### **1. What is Genesis?**

Genesis is a book of history, but not the kind we are accustomed to reading in modern history books. To understand the history presented in Genesis, the reader must supply the missing context, assumptions, religious imagery and sensibilities, and cultural elements that are implicit in the text. As William G. Dever expressed it: "The Bible cannot simply be read at face value as history; nor, of course, can any other ancient text be so read."<sup>3</sup>

One thing to which a modern reader of ancient religious history must be attuned is the patterned recurrence of themes that signal authorial intent. For example, in Nephi's record of his family's flight from Jerusalem and settlement in the New

World, there is a recurrent theme of obedience to the commandments of the Lord.<sup>4</sup> Recognizing the prominence of this theme in the writings of Nephi provides an important key to understanding what he wants his readers to learn from his account.

Likewise, Bible scholars have recognized a common thread that ties together the stories in the primeval history found in the first eleven chapters of Genesis. For example, the eminent Genesis scholar Ronald Hendel makes the case that one of the most prominent themes in these stories is “a series of . . . transgressions of boundaries”

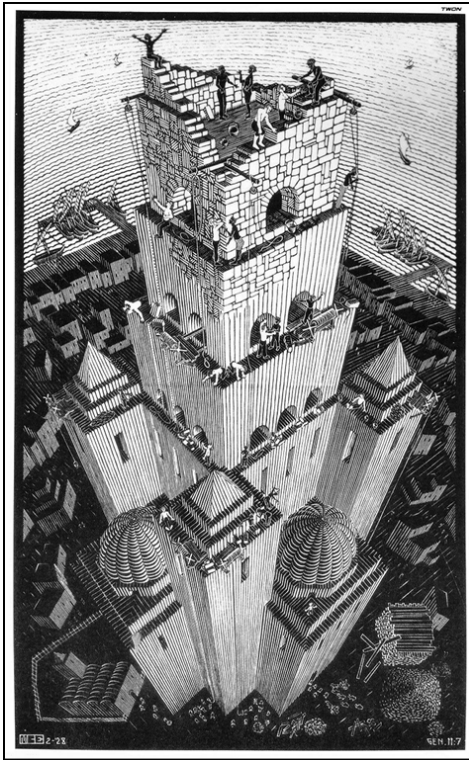


Figure 1: *Tower of Babel*, 1928  
M. C. Escher, 1898-1972

that had been set up in the beginning to separate mankind from the dwelling place of Divinity.<sup>5</sup> David Carr arrived at a similar conclusion, observing that both the pre-flood and post-flood stories of early mankind “end in the same place: a threat to the divine-human boundary and God’s work to reinforce it.”<sup>6</sup> Tryggve Mettinger also recognized the “stress on a borderline between the divine and human spheres . . . in Genesis 1-11.”<sup>7</sup> Similarly, Robert Oden highlighted “human aspirations to divine status” as an underlying theme in all these stories, and that such status “is ultimately denied them.”<sup>8</sup>

This general thesis is useful as far as it goes. In the stories of the transgressions of Adam and Eve, of Cain, of Lamech, of the “sons of God” who married the “daughters of men,” and of the builders of the Tower of Babel, we cannot fail to observe the common thread of a God who places strict

boundaries between the human and the divine. Surprisingly, however, a significant and opposite theme largely neglected by exegetes is that within some of these same chapters God is also portrayed as having sought to *erase* the divine-human boundary for a righteous few, drawing them into His very presence.<sup>9</sup> The prime examples of this motif are, of course, Enoch and Noah, of whom it was explicitly said that they “walked with God.”<sup>10</sup>

In considering the contrast in Genesis 1-11 between the limits set by God on the approach to the divine by transgressors on the one hand and His ardent efforts to draw the righteous into His immediate presence on the other, it is not without significance that many passages in these eleven chapters allude to the mythos of the temple in the Old Testament, where qualifications of purity and uprightness were integral to the granting of access to places of holiness — whether earthly or heavenly.<sup>11</sup> This is one of several reasons why portions of these chapters might be profitably considered as echoes of ancient temple texts.<sup>12</sup>



Figure 2: *Light and Color: The Morning After the Deluge (Goethe's Theory)* — *Moses Writing the Book of Genesis*, 1843  
Joseph Mallord William Turner, 1775-1851

## 2. Who wrote Genesis?

LDS teachings and scripture clearly imply that Moses learned of the Creation and the Fall in vision and was told to write it. However, most modern scholars find evidence that the book of Genesis as we have it was produced at a much later date than Moses plausibly could have lived. Can these views be reconciled?

In my view, the idea that scriptural figures may sometimes be more accurately regarded as the *authorities* rather than the *direct authors* or scribes for biblical books associated

with their names is not inconsistent with LDS acceptance of the Bible as scripture “as far as it is translated [and transmitted] correctly.”<sup>13</sup> Though I have no quarrel with the idea that the Old Testament, as we have it, might have been compiled at a relatively late date from many sources of varying perspectives and levels of inspiration, I accept that its major figures were historical and that the sources may go back to authentic traditions (whether oral or written), associated with figures such as Moses as authorities. John H. Walton and D. Brent Sandy express their views of this process as follows:<sup>14</sup>

Authority is not dependent on an original autograph or on an author writing a book. Recognition of authority is identifiable in the beliefs of a community of faith (of whom we are heirs) that God’s communications through authoritative figures and traditions have been captured and preserved through a long process of transmission and composition in the literature that has come to be accepted as canonical. That authority can be well represented in translation, though it can be undermined to the extent that interpretation (necessary for a translation to take place) misrepresents the authority. ...

Documents used in the compilation of Genesis are likely identified in the text itself (in eleven occurrences of “This is the account of ...”). No identification of the source of the traditions represented in the individual documents is offered, and this is not unusual. Documents such as those found in the first part of the book (Genesis 1-11) as well as those in the second part (Genesis 12-50) would correspond well, if only generally, to the sort that would be familiar in the ancient world. Likewise no indication is given in the book itself of the time or circumstances



under which these documents were compiled into the book as we know it. Earliest tradition associated the work with Moses, and given the stature of Moses that is not unreasonable, but we need not decide the matter. As discussed above, his role is best understood as tradent [i.e., transmitter of traditions], not likely that of actually generating the traditions (though he may have generated some of them—we particularly think of the creation accounts in this regard). ... Compilation of those documents into the complex literary work we call Genesis may not have happened for many centuries, though the traditions would have been well known.

In a discussion on Bible authorship, it is appropriate to introduce another class of ancient writings known today as pseudepigrapha. The word “pseudepigrapha” is commonly used to refer to “spurious or pseudonymous writings, especially Jewish writings ascribed to various biblical patriarchs and prophets.”<sup>15</sup> Importantly, however, the tenor of these definitions would seem to exclude the following situation:<sup>16</sup>

For example, if the sixth-century Daniel was the authority figure<sup>17</sup> who gave oracles that were duly recorded in documents that were saved until the second century, when someone compiled them into the book we have now and perhaps even included some updated or more specific information (provided by recognized authority figures in that time), that would not constitute pseudepigraphy or false attribution.<sup>18</sup> If that sort of process was an accepted norm, the attribution claims are not as specific and comprehensive as we may have thought when we were using more modern models of literary production. Authority is not jeopardized as long as we affirm the claims that the text is actually making using models of understanding that reflect the ancient world.

### 3. What is the book of Moses?

The book of Moses is an extract from the Joseph Smith Translation (JST) of Genesis.<sup>19</sup>

Previous scholars have observed that the Prophet’s Bible translation in general, and the book of Moses in particular, is not a homogeneous production.<sup>20</sup> Rather, it is composite in structure and eclectic in its manner of translation: some chapters contain long sections that have little or no direct relationship to the text of Genesis (i.e., the vision of Moses and the story of Enoch), while other chapters are more in the line of clarifying commentary that takes the text of the King James Version as its starting point, incorporating new elements based on Joseph Smith’s



Figure 3: *Moses Seeing Jehovah*, 1998.  
Joseph Brickey, 1973-

prophetic understanding.<sup>21</sup> According to Barlow, the most common type of change consists of “grammatical improvements, technical clarifications, and modernization of terms.”<sup>22</sup>

Some revelatory passages in the book of Moses have remarkable congruencies with ancient texts.<sup>23</sup> However, I think it fruitless to rely on JST Genesis as a means for uncovering a Moses *urtext*. Even if, for example, the longer, revelatory passages of chapters 1, 6, and 7 of the book of Moses were found to be direct translations of ancient documents, it is impossible to establish whether or not they once existed as an actual part of some sort of “original” manuscript of Genesis.

Mormons understand that the primary intent of modern revelation is for divine guidance to latter-day readers, not to provide precise matches to texts from other times. Because this is so, we would expect, rather, to find deliberate deviations from the content and wording of ancient manuscripts in Joseph Smith’s translations in the interest of clarity and relevance to modern readers. As one LDS apostle expressed it, “the Holy Spirit does not quote the Scriptures, but gives Scripture.”<sup>24</sup> If we keep this perspective in mind, we will be less surprised with the appearance here and there of New Testament terms such as “Jesus Christ” in Joseph Smith’s chapters on Enoch when the title “the Son of Man” would be more in line with ancient Enoch texts.<sup>25</sup>

#### **4. Is the Joseph Smith Translation of Genesis in a “final” form?**

Although I do not think it is necessary to believe that every word in our book of Genesis came from the pen of Moses, I am fully persuaded that Joseph Smith made his revisions as the result of his sincere and divinely guided efforts to fulfill a prophetic mandate from God.

However, I think it would be a mistake to assume that this work of scripture is currently in any sort of “final” form — if indeed such perfection in expression could ever be attained within the confines of what Joseph Smith called our “little, narrow prison, almost as it were, total darkness of paper, pen and ink; and a crooked, broken, scattered and imperfect language.”<sup>26</sup> As Robert J. Matthews, a pioneer of modern scholarship on the Joseph Smith Translation, aptly put it, “any part of the translation might have been further touched upon and improved by additional revelation and emendation by the Prophet.”<sup>27</sup>

There is another reason we should not think of the book of Moses as being in its “final” form. My study of the translations, teachings, and revelations of Joseph Smith has convinced me that he sometimes knew much more about certain sacred matters than he taught publicly. Indeed, in some cases, we know that the Prophet deliberately delayed the publication of early temple-related revelations connected with his work on the JST until several years after he initially received them.<sup>28</sup> Even after Joseph Smith was well along in the translation process, he seems to have believed that God did not intend for him to publish the JST in his lifetime. For example, writing to W. W. Phelps in 1832, he said: “I would inform you that [the Bible translation]

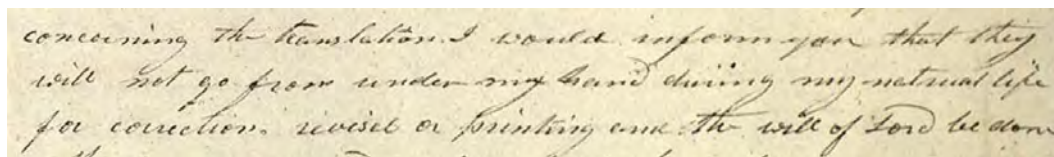


Figure 4: Joseph Smith, Jr. to William W. Phelps, 31 July 1832

will not go from under my hand during my natural life for correction, revisal, or printing and the will of [the] Lord be done.”<sup>29</sup> Although in later years Joseph Smith reversed his position and apparently made serious efforts to prepare the manuscript of the JST for publication, his own statement makes clear that initially he did not feel authorized to share publicly all he had produced — and learned — during the translation process. Indeed, a prohibition against indiscriminate sharing of some revelations, which parallels similar cautions found in pseudepigrapha, is explicit in the book of Moses when it says of some particularly sacred portions of the account: “Show them not unto any except them that believe.”<sup>30</sup> Such admonitions are consistent with a remembrance of a statement by Joseph Smith that he intended to go back and rework some portions of the Bible translation to add in truths he was previously “restrained ... from giving in plainness and fulness.”<sup>31</sup>

### Questions About Specific Verses in Genesis and the Book of Moses

Below are some frequently asked questions about scriptural verses in Genesis that bear on questions of science.<sup>32</sup>

#### 5. Moses 1:37-39: Are there other inhabited planets?

Modern revelation affirms the existence of other inhabited planets.

In a vision recorded in the Pearl of Great Price, Moses is given a glimpse of the extent of God’s work:<sup>33</sup>

37 And the Lord God spake unto Moses, saying: The heavens, they are many, and they cannot be numbered unto man; but they are numbered unto me, for they are mine.

38 And as one earth shall pass away, and the heavens thereof even so shall another come; and there is no end to my works, neither to my words.

39 For behold, this is my work and my glory — to bring to pass the immortality and eternal life of man.

In his scriptural account of the vision of the three degrees of glory, Joseph Smith affirmed that God’s children people at least some of these other worlds:<sup>34</sup>

23 For we saw him, even on the right hand of God; and we heard the voice bearing record that he is the Only Begotten of the Father —

24 That by him, and through him, and of him, the worlds are and were created, and the inhabitants thereof are begotten sons and daughters unto God.

That the worlds were not only created by the Son but also redeemed by him is made clear by the Prophet's poetic paraphrase of D&C 76:23-24:<sup>35</sup>

19. And I heard a great voice, bearing record from heav'n,  
     "He's the Savior, and only begotten of God —  
 By him, of him, and through him, the worlds were all made,  
     Even all that career in the heavens so broad,

20. Whose inhabitants, too, from the first to the last,  
     Are sav'd by the very same Savior of ours;  
 And, of course, are begotten God's daughters and sons,  
     By the very same truths, and the very same pow'rs."

Elder Neal A. Maxwell has written:<sup>36</sup>

Through [Joseph Smith's] multiple revelations and translations ... came a description of a universe far, far exceeding the astrophysics of the 1830s, a cosmos containing "worlds without number" and advising us further that the "inhabitants thereof are begotten sons and daughters [of] God."<sup>37</sup>

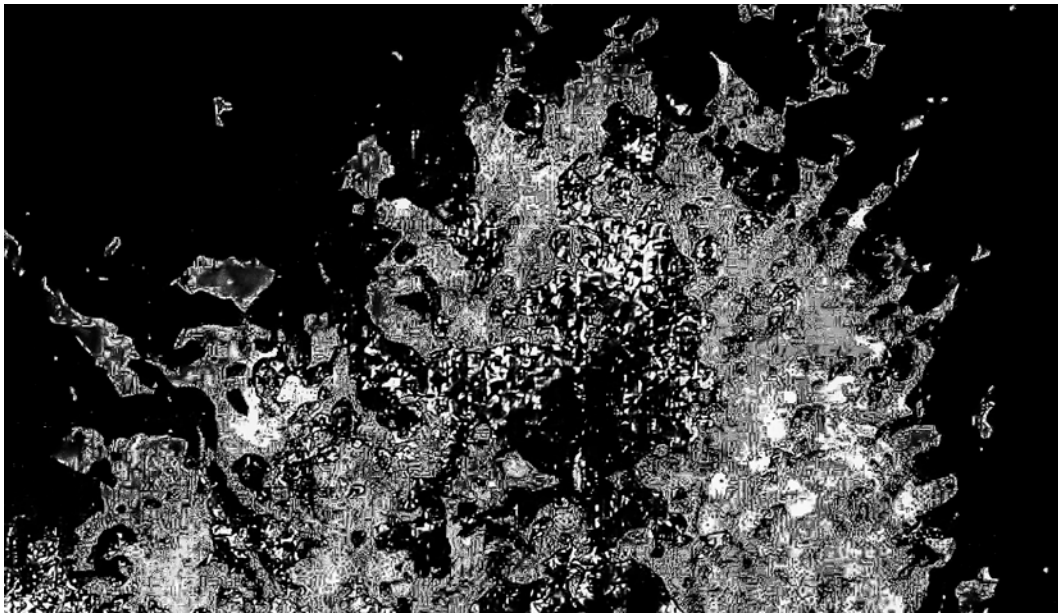


Figure 5: *Abstract No 78 — Creatio Ex Nihilo*, 2015  
 Radu Gavrilă, 1977-

## 6. Moses 2:1: How long did it take to create the earth?

With respect to the creation accounts in scripture, the Latter-day Saints have avoided some of the serious clashes with science that have troubled other religious traditions. For example, members of the Church have no quarrel with the concept of a very old earth whose "days" of creation seem to have been of very long, overlapping, and varying duration.<sup>38</sup> Indeed, Joseph Smith himself is remembered as having

taught that the heavenly bodies were created long prior to the earth: “The starry hosts were worlds and suns and universes, some of which had being millions of ages before the earth had physical form.”<sup>39</sup> Consistent with this stance, LDS scientists such as David Bailey<sup>40</sup> have competently summarized scientific inadequacies and theological incompatibilities of the creationist movement in both its “young earth” and “intelligent design” forms. Despite what some advocates of a creationist agenda would have people believe, to question specific features of the theories they have advanced is not tantamount to rejecting the concept of a Divine Creator. Many devout scientists and other scholars have found other ways to reconcile their scientific views on the origin of the universe with their belief in God.<sup>41</sup>

### **7. Moses 2:1: Was the earth created from nothing?**

Whereas the idea of God’s organizing the world from preexisting matter was a part of many ancient cosmologies, Jewish scholars began to articulate the alternative doctrine of creation *ex nihilo*<sup>42</sup> (literally “out of nothing”) by the later part of the second temple period.<sup>43</sup> *Ex nihilo* creation subsequently became the prevalent interpretation in the Christian tradition.<sup>44</sup>

By way of contrast, Joseph Smith stated that the word “created” should be rendered “formed, or organized.”<sup>45</sup> This is because, said he, the term “does not mean to create out of nothing; it means to organize — the same as a man would organize materials and build a ship. Hence we infer that God had materials to organize the world out of ... chaotic matter.”<sup>46</sup> In his analysis of the subject, Kevin Barney concludes that historical and scientific evidence “strongly favors Joseph Smith’s rejection of *creatio ex nihilo*.”<sup>47</sup>

### **8. Moses 2:3-4: What was nature of the light that was created in the beginning?**

The nature of the light referred to in Moses 2:3 is not explained. Several possibilities have been suggested. Some interpreters see this event as consonant with the prevailing scientific view that describes the birth of our universe as a sudden burst of light and energy of unimaginable scale. Others see this phrase as referring to a “local” event whereby the natural light of the sun was created.<sup>48</sup> It is, of course, a given that the sun was created prior to the fourth day, though from the vantage point of earth, no light will “appear in the firmament” until that later time.<sup>49</sup>

In contrast to such naturalistic readings, Hugh Nibley’s interpretation seems more consistent with related scriptural passages — namely, that the light referred to was the result of God’s presence: “All this time the Gods had been dwelling in light and glory, but the earth was dark. ... This was not the first creation of light. Wherever light comes into darkness, ‘there is light.’”<sup>50</sup> Consistent with this view, President John Taylor wrote that God:<sup>51</sup>

caused light to shine upon [the earth] before the sun appeared in the firmament; for God is light, and in him there is no darkness.<sup>52</sup> He is the light of the sun and



Figure 6: *The Creation of Light*, 1913  
Gaetano Previati, 1852-1920:

the power thereof by which it was made; he is also the light of the moon and the power by which it was made; he is the light of the stars and the power by which they are made.”

D&C 88:12-13 continues this description to make it clear that this “light” is something over and above mere physical light as generally conceived, since it not only “enlighteneth your eyes” but also “quickeneth your understandings,” governs and “giveth life to all things,” and “proceedeth forth from the presence of God to fill the immensity of space.”<sup>53</sup> As Isaac Watts expressed in one of his hymns:<sup>54</sup>

In vain the bright, the burning sun  
Scatters his feeble light;  
'Tis Thy sweet beams create my noon;  
If Thou withdraw, 'tis night.

The idea of God Himself as the source of this special “light” is consistent with many ancient sources.<sup>55</sup> For example, rabbinical commentators saw the light at the beginning of Creation as the splendor of God Himself, who “cloaked himself in it as a cloak” and it “shone forth from one end of the world to the other.”<sup>56</sup> A corresponding light was said to fill the place of God’s presence in the temple:<sup>57</sup>

The brightness of the Holy of Holies was the light of Day One, before the visible world had been created. ... Those who entered the Holy of Holies entered this place of light, beyond time and matter, which was the presence of “the King of kings and Lord of lords who alone has immortality and dwells in unapproachable light.”<sup>58</sup> This was the place of glory to which Jesus knew he would return after the crucifixion, “the glory which I had with thee before the world was made.”<sup>59</sup> In the *Gospel of Thomas*,<sup>60</sup> Christians are described as the new high priesthood who enter

the light, and Jesus instructed his disciples to say to the guardians [the cherub guardians of Eden?]: “We came from the light, the place where the light came into being on its own accord and established [itself] ...”

### **9. Moses 2:5: How did “day and night” appear before the sun and moon were created?**

A first notion of “time” appears only after the primeval unity was first divided. Note that evening and morning signify respectively, not the earth’s daily sunset and dawning, but rather the suspension and resumption of distinct “times” of divine creativity, corresponding to groups of works performed.<sup>61</sup>

Note that like the Egyptian practice (and unlike the system that governs the current Jewish religious calendar) each “day” of Creation begins with the dawn.<sup>62</sup> Thus Cassuto translates: “And there was evening and there was morning, one day,” and then comments: “When daytime had passed, the period allotted to darkness returned (and there was evening), and when night-time came to an end, the light held sway a second time (and there was morning), and this completed the first calendar day (one day), which had begun with the creation of light.”<sup>63</sup> Abraham’s account of the Creation follows the same scheme, though with a difference in how it is formulated.

The Hebrew expression means “Day One,” differing from subsequent periods of Creation that are described using cardinal numbers (e.g., second, third). According to Margaret Barker, some Jewish sages “remembered this as the Day (or the State) in which the Holy One was one with his universe. Day One was thus the state of unity underlying (rather than preceding) all the visible creation ... Those who entered the Holy of Holies[, the place in the temple representing both the state before Creation and the state of oneness that would eventually prevail again,<sup>64</sup>] understood how that original unity had become the diversity of the visible creation ... [where] everything was created distinct, according to its kind.”<sup>65</sup>

### **10. Moses 2:5: How long was each day of creation?**

The Hebrew term for day, *yom*, is not used to refer only to a fixed twenty-four-hour period but also to a period of indeterminate length, as in the expression the “day of the Lord”<sup>66</sup> or in Moses 3:4, where it is used to signify the entire period of Creation.<sup>67</sup> Thus, we are not limited to supposing the Creation was accomplished in six solar days or six thousand years, but rather we can view the “week” of Creation as part of seemingly overlapping periods of long and varying length.<sup>68</sup>

### **Moses 2:6-7: What are the “waters” referred to here? What is meant by the word “firmament”?**

The most obvious implication of Abraham 4:2 is that the “waters” correspond to the terrestrial seas that covered the earth following its initial creation. However some





Figure 7: *The Second Day of Creation*, 1925

M. C. Escher, 1898-1972

have associated the term “water” in its singular form with unorganized matter — the unexplained unity that existed prior to the creation process of demarcation, distinction, separation, and naming.<sup>69</sup> Summarizing the opinion of Jewish sages, Zlotowitz writes:<sup>70</sup>

The “water” mentioned in this verse is not the water that is in the “seas.”<sup>71</sup> It is clear that there was a certain common matter which was called “water.” Afterwards, it was divided into three forms; a part of it became “seas,” another part of it became “firmament”; a third part became that which is above the “firmament” — entirely beyond the earth.<sup>72</sup> Perhaps this is why ... water is invariably in the plural form — suggestive of this pluralistic division.

*Genesis Rabbah* suggests that a “watery” origin of all things is behind the etymology of the plural term “heavens”: “And God called the firmament heaven (*sha*).”<sup>73</sup> Rav said: *Shamayim* is a composite of *esh* (‘fire’) and *mayim* (‘water’). The Holy One took fire and water, and worked them into each other, and out of the two, heaven was made.”<sup>74</sup>

From the point of view of the physical creation, Moses 2:6-7 seems to be describing how the waters were “‘divided’ between the surface of the earth and the atmospheric heavens that surround it.”<sup>75</sup> However, in the cosmic temple symbolism of Creation, the “firmament” that separated heaven from earth symbolizes the veil that divided off the Holy of Holies in the earthly temple.<sup>76</sup>



The Prophet's translation of Abraham 4:6 (which reads "expanse" instead of "firmament") may have been informed by his study of Hebrew in Kirtland, where a more precise rendering of Genesis into English would be: "And Elohim said, Let there be an *expanse* in the midst of the waters and let it divide the waters and the waters."<sup>77</sup> Joshua Seixas' *Grammar*, which was the basis of Joseph Smith's study, notes "expanse" as the meaning of the corresponding Hebrew term for the KJV "firmament."<sup>78</sup> "The verbal form is often used for hammering out metal or flattening out earth, which suggests a basic meaning of 'extending,'"<sup>79</sup> and could well apply to the spreading out of a curtain or veil.

**11. Abraham 4:10, 12, 18, 21, 25: Do the words "the Gods watched those things which they had ordered until they obeyed" (4:18) imply that every created thing exercised its own volition in complying with divine governance?**

With respect to mankind, the theme of obedience to the commandments of God is introduced in Abraham 3:24-25: "We will go down, for there is space there, and we will take of these materials, and we will make an earth whereon these may dwell; And we will prove them herewith, to see if they will do all things whatsoever the Lord their God shall command them." Elsewhere in scripture, the perfect compliance of the elements is contrasted to the disobedience of man:<sup>80</sup> "O how great is the nothingness of the children of men; yea, even they are less than the dust of the earth. For behold, the dust of the earth moveth hither and thither, to the dividing asunder, at the command of our great and everlasting God."

That said, it should be noted that the definition of "obey" in Noah Webster's 1828 *Dictionary*, a near-contemporary publication to the scriptures and revelations of Joseph Smith, includes a sense that describes the "obedience" of inanimate elements in terms of the effects of natural law by which such objects of necessity comply:<sup>81</sup> "To yield to the impulse, power or operation of; as, to *obey* stimulus. 'Relentless time, destroying power, Whom stone and brass *obey*.'" Thus, in the context of scripture, the idea that the elements "obeyed" need mean no more than that they were subject to divinely ordained laws that governed their operations without requiring the notion that there was an exercise of willful volition on their part.

**12. Moses 2:11, 12, 21, 24, 25: What are we to understand by the expression that each living creature was to multiply "after his kind"?**

Elder Boyd K. Packer has written: "No lesson is more manifest in nature than that all living things do as the Lord commanded in the Creation. They reproduce 'after their own kind.'<sup>82</sup> They follow the pattern of their parentage."<sup>83</sup> The Prophet Joseph Smith said that it is a "fixed and unalterable ... decree of the Lord that every tree, fruit, or herb bearing seed should bring forth after its kind, and cannot come forth after any other law or principle."<sup>84</sup> From a scientific perspective, this "decree" is expressed within the elegant economy of the laws of genetics and the effects of natural selection, all in conformance with the foreknowledge and governing power of God. Thus, it is unnecessary to interpret relevant scriptures to mean that, once

created, the descendants of any kind of “living thing” will be forever immutable in form. The sophisticated formulations of concepts relating natural kinds and species in modern biology<sup>85</sup> do not correspond to the commonsense notion of “kinds” in Genesis.

**13. Abraham 4:21, 24: What is the significance of the passages in the book of Abraham that say that “the Gods prepared the waters that they might bring forth great whales” (4:21) and that “the Gods prepared the earth to bring forth the living creature” (4:24)?**

Hugh Nibley gives his view as follows:<sup>86</sup>

[W]hat [the Gods] ordered was not the completed product, but the process to bring it about, providing a scheme under which life might expand. ... Note the future tense: the [earth is] so treated that [it] will have the capacity. The Gods did not make [grass] on the spot but arranged it so that in time they might appear. They created the potential.



Figure 8: *The Garden of Eden*, ca.1828  
Thomas Cole, 1801-1848

**14. Moses 3:2-3: What are we to understand by the fact that God “rested on the seventh day from all [his] work”?**

In the Bible as well as in other ancient Near East creation accounts, “rest” is conceived as the culminating event of Creation, when order and divine dominion achieve their final triumph over chaos. Thus, in the biblical account, as in *Enuma Elish*,<sup>87</sup>

God rests when His work is finished.<sup>88</sup> When He does so, taking His place in the midst of creation and ascending to His throne, a temple-universe made with divine hands comes into full existence as a functional sanctuary<sup>89</sup> — a “control room of the cosmos,”<sup>90</sup> as John Walton terms it. This current scholarly understanding of the process outlined in Genesis 1 as the organization<sup>91</sup> of a world fit to serve as a dwelling place for God is in contrast to the now scientifically<sup>92</sup> and theologically<sup>93</sup> discredited traditional view that the biblical story merely describes in poetic terms the discrete steps of an *ex nihilo* material creation followed by a simple cessation of activity. Instead, from this updated perspective we can regard the seventh day of creation as the enthronement of God and the culmination of all prior creation events.<sup>94</sup> True rest is finally achieved only when God rules supreme in His divine temple — and His righteous and duly-appointed king rules on earth. This state of rest existed for a time when the earth was first created, and will recur at the end of the earth’s temporal mission when the earth is celestialized as part of a new Creation.<sup>95</sup>

**15. Moses 3:5: What is meant by the scripture that says that God “created all things, of which I have spoken, spiritually, before they were naturally upon the face of the earth”?**

By “spiritual creation” is not meant, in this instance, a separate creation of entities made of “spirit” corresponding to each created thing, but rather the premortal creation of “all things” in their spiritual *state*, including the physical creation of Eden and everything in it. This is consistent with the view of Elder Bruce R. McConkie, who “conceded that the word ‘spiritual’” in Moses 3 has “a dual meaning and applies to both the premortal life and the paradisiacal creation ... [while emphasizing] that the ‘more pointed and important meaning’ is that of a ‘paradisiacal creation.’”<sup>96</sup>

Some readers see the planning process for the formation of the heavens and the earth as resulting in a “blueprint” that can be taken as constituting a sort of spiritual creation.<sup>97</sup> Though advance planning doubtless took place, such a process is never referred to in scripture as a form of spiritual creation.

Note that the period of time mentioned in D&C 77:6 refers to “the seven thousand years” of the earth’s “temporal existence,” rather than to the period of its existence in a spiritual state. Thus, this seven thousand year period does not include the timeframe of the physical Creation of the earth in its spiritual state, nor the time that led up to the Fall of Adam and Eve. Therefore, the rough characterization of time periods in D&C 77:6 is not inconsistent with a creation process that began billions of years ago.

**16. Moses 3:5: What do we know from scripture about the creation of mankind?**

Joseph Smith taught that there is some aspect of the spirit’s existence that was not created, although the exact nature of this eternal part of man has not been authoritatively settled.<sup>98</sup> In the book of Moses, we are told very little about the

premortal creation of human spirits and the physical creation of the human body. The fact that all mankind existed as spirits in “heaven” before they came to earth is stated in simple terms.<sup>99</sup> The formation of man’s physical body from the “dust of the earth” and woman’s from the “rib” of the man are described in figurative terms.<sup>100</sup> Additionally, the book of Abraham makes it clear that when God breathed the “breath of life” into man, it meant that He took Adam’s spirit and associated it with his body.<sup>101</sup>

With respect to the premortal life of man’s spirit, the phrase “and all the host of them” that follows the statement that “the heaven and the earth were finished” has long been a subject of discussion and speculation. The belief that “angels,” “sons of God,” and/or “the souls of humanity” were part of that “host” and that they were created prior to everything else appears in the book of Job,<sup>102</sup> in extracanonical books such as *Jubilees*,<sup>103</sup> and in the teachings of Elder Joseph Fielding Smith.<sup>104</sup>

The Prophet summarized: “The organization of the spiritual and heavenly worlds, and of spiritual and heavenly beings, was agreeable to the most perfect order and harmony: their limits and bounds were fixed irrevocably, and voluntarily subscribed to in their heavenly estate by themselves, and were by our first parents subscribed to upon the earth.”<sup>105</sup> Thus, “Father Adam, the Ancient of Days and father of all, and our glorious Mother Eve,” among the “noble and great ones” who excelled in intelligence in their premortal life, were foreordained to their mortal roles.<sup>106</sup> Having received perfect physical bodies, Adam and Eve were placed in a specially prepared proving ground where, until the time of their transgression, they would live in a spiritual state.



Figure 9: “*There Went Up a Mist from the Earth*,” 2011  
Ignasi Montserrat i Quevedo

### 17. Moses 3:6: What is meant by the phrase “there went up a mist from the earth”?

Moses 3:5 says that “the Lord God had not caused it to rain upon the face of the earth ... and not yet a man to till the ground.” Apparently, water in the Garden of Eden was to be provided by natural irrigation and not by rain.

The English term “mist” seems out of place here, however there is evidence that the obscure Hebrew *‘ed* and the Akkadian *edu*, “flood, waves, swell” might be connected.<sup>107</sup> Thus one might translate this phrase as: “a flow [or ‘spring’]<sup>108</sup> would well up from the ground and water the whole surface of the earth.”<sup>109</sup> This is consistent with being told later that “the Lord God caused a river to go out of Eden to water the garden.”<sup>110</sup> Unlike the uncertain flows of the desert *wadi* that swelled when God provided rain and dried up when rain was withheld, the continuous flow of water from the deep assured the garden of unfailing fertility.<sup>111</sup> Moreover, in connection with the figurative account of man’s creation in v. 7, some commentators conclude that the resulting mixture of soil and water provided, poetically, “the raw material with the proper consistency for being molded into man.”<sup>112</sup>

### **18. Moses 3:7: What does the term “living soul” mean? Does everything that God created possess an individual spirit?**

D&C 88:15 explains that “the spirit and the body are the soul of man.” The book of Moses specifies further that man,<sup>113</sup> the trees,<sup>114</sup> and the animals<sup>115</sup> in the Garden became “living souls” once the result of their prior spiritual creation was combined with natural elements. However, the fact that the trees of the garden became “living souls” does not necessarily imply that each tree possessed an individual spirit in the same sense that man and animals do.

The book of Moses says nothing directly about the process of the creation of individual spirits. Later revelation and teachings of Church leaders have made it clear that both humans and animals<sup>116</sup> possess individual spirits that predated their physical bodies.<sup>117</sup> The Prophet Joseph Smith taught: “There is no such thing as immaterial matter. All spirit is matter, but it is more fine or pure, and can only be discerned by purer eyes.”<sup>118</sup>

D&C 77:2 states that “the spirit of man [is] in the likeness of his person, as also the spirit of the beast, and every other creature which God has created.”<sup>119</sup> On this specific matter, there can be little disagreement. However, it is clear from other prophetic teachings that this “likeness” is only general in nature and that, for example, we cannot infer the precise form of the spirit from the physical body it inhabits on earth.<sup>120</sup> In addition, what constitutes a “beast” or a “creature”<sup>121</sup> in the context of D&C 77:2 has sometimes been debated. For example, Stephens and Meldrum ask whether the fact that everything was created spiritually in the beginning necessarily implies that every form of microscopic life possesses an individual spirit, an idea that on the face of it seems absurd.<sup>122</sup> Moreover, though some early Church leaders believed that there was some sense in which there is “life” in all matter “independent of the spirit given of God to undergo this probation,”<sup>123</sup> we need not conclude that elemental matter possesses “intelligence” or individual volition. Moreover, the idea that every instance of plant life possesses an individual spirit in the likeness of its physical form seems unreasonable.<sup>124</sup> Notably, in Moses and Abraham, the compound term “living creature” is reserved for animals.<sup>125</sup>



Note that some LDS commentators have interpreted the account of Moses 2 as referring to the creation of all things in spirit form.<sup>126</sup> In a more limited way, others have associated Moses 2:26-27 with the creation of the spirits of all mankind.<sup>127</sup> Such ideas, however, have fallen into general disfavor. In any case, LDS teachings seem to be in agreement that the account given in Moses 3:6-7 describes, though in a figurative manner, the creation of a perfect physical body for Adam. Following the creation of his body, Adam was placed in the Garden of Eden, a “spiritual” realm of the terrestrial order.

**19. Moses 3:7: Does the description of Adam as being “the first flesh upon the earth, the first man also” imply that he was created before any living creature? Does it necessarily imply “special creation” of man?**

This verse has long been an interpretive problem for LDS readers, since at face value the phrase seems to be saying that man’s appearance on earth preceded that of the animals — and thus strongly implying that man’s body must have been formed through “special creation.”<sup>128</sup> However, adopting the most common way this verse has been understood in recent times, Draper et al., comment: “‘Flesh’ here, of course, refers to mortality — Adam was the first mortal human being on the earth.”<sup>129</sup> This interpretation is consistent with the majority of scriptural references to the term “flesh.”<sup>130</sup> Elder Joseph Fielding Smith agreed, arguing that the phrase should not be interpreted to mean that animal life was not present on earth prior to Adam’s coming to live there.<sup>131</sup>



Figure 10: *Adam and Eve in Paradise (top) and in the Cave of Treasures (middle). Cain and Abel Sacrificing and in Conflict (bottom and top left/right), 12th century*

**20. Moses 3:8: What is meant by the phrase “eastward in Eden”?**

There is reason to believe that “eastward” may refer to the Garden of Eden’s position relative to the Creator as laid out in the spiritual coordinates which describe that realm. The initial separation of Adam and Eve from God occurs when they are removed from His presence to be placed in the Garden “eastward in Eden” — that is, downward and eastward from the top of the “mountain” where, in some representations of the sacred geography of Paradise, He is said to dwell.<sup>132</sup> In some early Christian accounts, Adam

and Eve, after the Fall, dwelt in a temple-like retreat in the heart of the mountain of God that was called the “Cave of Treasures” — the “treasures” referring to sacred

objects associated with the priesthood that were restored to the Christ child by the Magi after His birth.

Later events repeatedly associate eastward movement with increasing distance from God.<sup>133</sup> For example, after God's voice of judgment visits Adam and Eve "from the west,"<sup>134</sup> they experience an additional degree of separation when they are expelled through the Garden's eastern gate.<sup>135</sup> Cain was "shut out from the presence of the Lord" as he resumed the journey eastward to dwell "in the land of Nod, on the east of Eden,"<sup>136</sup> a journey that eventually continued "from the east" to the "land of Shinar" where the Tower of Babel was constructed.<sup>137</sup> Finally, Lot traveled east toward Sodom and Gomorrah when he separated himself from Abraham.<sup>138</sup> On the other hand, Abraham's subsequent "return from the east is [a] return to the Promised Land and ... the city of Salem,"<sup>139</sup> being "directed toward blessing."<sup>140</sup> The Magi of the Nativity likewise came "from the east" to Bethlehem.<sup>141</sup>



Figure 11: Adam's Peak, 1780

From Antoine-François Prévost, *Voïages*

To an ancient reader in the Mesopotamian milieu, the phrase "eastward in Eden" might also be taken as meaning that the Garden of Eden sits at the dawn horizon — the meeting place of heaven and earth — symbolic imagery associated with ancient temples. The pseudepigraphal *Conflict of Adam and Eve with Satan* skillfully paints such a picture: "On the third day, God planted the Garden in the east of the earth, on the border of the world eastward, beyond which, towards the sun-rising, one finds nothing but water, that encompasses the whole world, and reaches unto the borders of heaven."<sup>142</sup> This idea corresponds to the Egyptian *akhet*, the specific place where the sun god rose every morning and returned every evening, and also to the Mandaean "ideal world" which was held to hang "between heaven and earth."<sup>143</sup> The Chinese *K'un-lun* also "appears as a place not located on the earth, but poised between heaven and earth."<sup>144</sup> The gardens of *Gilgamesh* and the Ugaritic Baal and Mot were liminally located at the "edges of the world" or, in other words, "at the

borders between the divine and the human world.”<sup>145</sup> Similarly, *2 Enoch* locates paradise “between the corruptible [earth] and the incorruptible [heaven].”<sup>146</sup>

By its very nature, the horizon is not a final end point but rather a portal, a place of two-way transition between the heavens and the earth. Writes Nibley: “Egyptians ... never ... speak of [the land beyond the grave] as an earthly paradise; it is only to be reached by the dead.’ ... [It] is neither heaven nor earth but lies between them. ... In a Hebrew Enoch apocryphon, the Lord, in visiting the earth, rests in the Garden of Eden and, moving in the reverse direction, passes through ‘the Garden to the firmament.’<sup>147</sup> ... Every transition must be provided with such a setting, not only from here to heaven, but in the reverse direction in the beginning.”<sup>148</sup>

“The passage from world to world and from horizon to horizon is dramatized in the ordinances of the temple, which itself is called the horizon.”<sup>149</sup> Situating this concept with respect to the story of Adam and Eve, the idea is that the Garden “was placed between heaven and earth, below the firmament [i.e., the celestial world] and above the earth [i.e., the telestial world], and that God placed it there ... so that, if [Adam] kept [God’s] commands He might lift him up to heaven, but if he transgressed them, He might cast him down to this earth.”<sup>150</sup>

## 21. Moses 3:8: Where was the Garden of Eden located?

While it would be foolish to speak of any final solution to the problem of reconciling science and scripture on specifics relating to the Garden of Eden and the nature of life before the Fall, three groups of general possibilities are briefly considered below.

### 1. *Eden located on the earth as a place where special conditions prevailed.*

This scenario, advocated by Draper et al., posits that Eden existed at a specific location on the earth, and that “spiritual” conditions governed life in the Garden before the Fall while, at the same time, “natural” conditions prevailed elsewhere on the earth.<sup>151</sup> Such a proposal accords well with a common LDS view that attributes a continuous identity of the physical earth from its creation in a spiritual state, to its “Fall” to a telestial one, to its eventual transformation to a paradisiacal millennial state, and ultimately to a glorified celestial status.<sup>152</sup> It also provides an explanation for ancient fossil remains by allowing for death and disease to have taken place for an indefinite period of time outside the Garden, while deathless conditions are seen as having prevailed before the Fall for Adam and Eve and all else within Eden’s precincts.<sup>153</sup> On the other hand, nothing in the scriptural description of the Garden’s four rivers springing from one head seems to correlate easily with the geography of Missouri (or anywhere else on the earth, for that matter), either present or past. Moreover, it seems awkward to try to think of a single earth existing in a hybrid state — partly spiritual and partly natural.<sup>154</sup> Finally, this proposal offers no guidance about how to reconcile current scientific thinking with statements from scripture and early Church leaders



that seem to imply that the earth was moved from one location in the universe to another (more on this in the next question below).

2. *Eden situated in a different place or “state” than the earth as we know it.* A second possibility is that the events of the Fall did not take place on the earth as we know it. For example, the bodies of Adam and Eve could have been prepared in some manner beforehand on the earth<sup>155</sup> and afterward the couple could have been temporarily placed in a terrestrial environment to experience the events of the Garden of Eden.<sup>156</sup> As with the first possibility discussed above, this interpretation of the story would be consistent with the implication of Moses 3:8 that the bodies of Adam and Eve were created outside the Garden (i.e., on the earth?<sup>157</sup>) and only later placed in Paradise (“there I put the man whom I had formed”<sup>158</sup>). In this view, special conditions, perhaps paralleling those that characterize worlds where translated beings dwell,<sup>159</sup> would have been required as part of the design of the Garden of Eden.<sup>160</sup> An important consequence of this view is that the subsequent Fall would not have required the movement of an entire planet from one place to another, but only the removal of Adam and Eve from the state or place of Eden to the telestial earth (a form of “reverse translation”) — an earth where natural conditions (including death and “time”) had already prevailed from the beginning of its creation.<sup>161</sup> A strong point of this proposal is that it allows for an earth consistent with scientific findings of a long and continuous biological, geographical, and planetary history. Finally, several ancient parallels can be taken as suggesting the idea that the Garden was not on the earth but rather in a place of a higher order or “sphere” to which Adam and Eve were “transplanted” from the earth.<sup>162</sup>
3. *Eden as a place whose description includes figurative elements.* The blend of figurative elements in the stories of the Creation, the Fall, and the Garden of Eden provides a powerful means to teach complex ideas that would be difficult to comprehend and recall if presented in purely abstract terms. Though affirming the identity of Adam and Eve as historical figures, the reality of the Fall, and the tangible nature of the “sacred space” of Eden, Joseph Fielding McConkie is not troubled by the presence of symbols and metaphors in scriptural accounts:<sup>163</sup>

What, then, do we conclude of the Eden story? Was it figurative or literal? We answer by way of comparison. It, like the temple ceremony, combines a rich blend of both. Our temples are real, the priesthood is real, the covenants we enter into are real, and the blessings we are promised by obedience are real; yet the teaching device may be metaphorical. We are as actors on a stage. We role-play and imagine. We do not actually advance from one world to another in the temple, but rather are taught with figurative representations of what can and will be. ... In the story of man’s earthly origin we find the rich blend of figurative and literal that is so typical of the Bible, of

the teachings of Christ, and of our daily experience — this that the story might unfold according to the faith and wisdom that we bring to it. Like all scriptural texts, its interpretation becomes a measure of our maturity and our spiritual integrity.

In support of the third view above, which is not necessarily incompatible with the other interpretations discussed above, it should be admitted that the scriptural details of locations and specific events in Moses 3-4 are obscure, and that there is a strong symbolic component of many of the descriptions of the places, characters, props, and events of Eden. In fact, Faulconer explains that reading scripture “typologically, figurally, anagogically, or allegorically” is not what a premodern would have done.<sup>164</sup>

instead of or in addition to reading literally. Such readings are part and parcel of a literal reading. Premodern understanding does not reduce the biblical story to a reference to or representation of something else, though it also does not deny that there may be an important representative element in scripture.<sup>165</sup> Instead, premoderns believe that to understand the story of Israel is essentially to understand history — actual history, the real events of the world — as incarnation, a continuing incarnation, as types and shadows.

## **22. Moses 3:9: After the Fall, was the earth physically moved from a place near Kolob to its current location?**

In a single brief enigmatic reference, Moses 3:9 elaborates on the spiritual state of existence that applied to all things in the Garden: “it was spiritual in the day that I created it; for it remaineth in the sphere in which I, God, created it.” The use of “for” to introduce the dependent clause of this verse seems to imply that the spiritual state of the Garden was due to the fact that it had remained in a particular “sphere.” This raises the question as to what is meant by the term “sphere.”

The first thing to notice is that the Prophet Joseph Smith never used “sphere” in the contemporary English sense of a “globe” or a “celestial body,” preferring the terms “world” or “planet” when that meaning was intended. In his revelations and teachings, “sphere” always refers to one of three things:

1. the orbit or order of a heavenly body;<sup>166</sup>
2. a domain of thought;<sup>167</sup>
3. a realm of activity, power, or influence.<sup>168</sup>

In the context of Moses 3:9, only the first and third of the senses could reasonably apply. However, since the book of Abraham<sup>169</sup> strongly correlates increases in proximity of orbit with higher orders of celestial governance, these two senses, in fact, converge. Taken together with Abraham 5:13 and D&C 130:4 — which imply that the “reckoning” of time of the Garden in its spiritual state was “after the Lord’s time, which was after the time of Kolob”<sup>170</sup> — the implication seems to be that the

prelapsarian Garden of Eden was “nigh unto Kolob,”<sup>171</sup> with events after the Fall occurring in another sphere — and hence in a different state.<sup>172</sup>

This interpretation immediately raises serious issues. For one thing, a view that the earth was physically transported from one position in space to another is impossible to harmonize with current planetary science unless one makes the very doubtful assumption, as does Hyrum Andrus,<sup>173</sup> that under the special conditions prevailing at the time of Creation “it may have been possible to move the earth in space at a great speed without the disruption that might otherwise accompany such a move.” For such a view to be plausible, not only would the movement of Earth itself have to be considered, but also the fact that “the solar system is a multiple body system with many complex interactions taking place.”<sup>174</sup> Equally problematic is the fact that all lines of scientific evidence support the conclusion that both the sun and the earth were created at about the same time from the same source, and that the earth was part of our solar system from its beginning.

### **23. 2 Nephi 2:22-23: Does the Book of Mormon imply that there was no death before the Fall?**

Scriptural descriptions of the Garden of Eden not only seem to imply that something about its “time,” but also its “state,” and “sphere,” differed from the postlapsarian environment of Adam and Eve. Lehi explained that had it not been for the Fall, “All things which were created must have remained in the same state in which they were after they were created; and they must have remained forever, and had no end.”<sup>175</sup> Some readers take this verse as an argument that death did not occur before the Fall. However, there are other ways of interpreting this passage of scripture. In this connection, Stephens and Meldrum ask:<sup>176</sup>

What does the term “all things” refer to? Verse 23 appears to refer to Adam and Eve only, and verse 24 uses the term “all things” twice to refer to concepts. Can we be certain that “all things” in verse 22 means Adam, Eve, all the animals, and all the plants? Could the term “things” simply mean conditions? ... If Adam had not transgressed, his condition of immortality in the Garden would have continued indefinitely.

Perhaps more convincingly, Robert W. Clayton observes:<sup>177</sup>

The meaning of [2 Nephi 2:22-23] must be carefully evaluated. “The state in which they were after they were created” (for plants and animals) is not defined anywhere in scripture. “And had no end” does not necessarily mean eternal life, just a continuation of state. It could mean the creations were mortal and would have continued mortal forever, with no hope of eternal continuance. The word “they” refers to Adam and Eve throughout the chapter, but the meaning of “they” is grammatically unclear in verse 22. Verse 23 picks right back up with “they” referring to Adam and Eve, suggesting it is Adam and Eve in verse 22 who would have “remained forever and had no end.”

In light of Clayton's conjectures, I propose that these verses should be punctuated as follows:

22 And now, behold, if Adam had not transgressed he would not have fallen, but he would have remained in the garden of Eden, and all things which were created must have remained in the same state in which they were after they were created.

23 And they must have remained forever, and had no end, and they would have had no children; wherefore they would have remained in a state of innocence.

Expressing a related idea, Moses 3:9 says that, "all things which I prepared for the use of man" were "spiritual" when they were created, for they remained "in the sphere in which I, God, created [them]." Everything placed in the Garden of Eden was, of course, also considered "spiritual." We are told in Moses 3 that man, the trees, and the animals became "living souls" when they were formed from a combination of spiritual and natural elements.<sup>178</sup> All things were considered "spiritual" in the sense that they were in a state of relative perfection before the Fall.<sup>179</sup>



*Harold B. Lee*  
1899-1973



*James E. Talmage*  
1862-1933



*Harvey Fletcher*  
1884-1981

There is a wide spectrum of beliefs in the Church regarding the question of how death entered the world.<sup>180</sup> President Harold B. Lee gave the following description of the effects of Adam and Eve's transgression on the rest of creation:<sup>181</sup>

Besides the Fall having had to do with Adam and Eve, causing a change to come over them, that change affected all human nature, all of the natural creations, all of the creation of animals, plants — all kinds of life were changed. The earth itself became subject to death. ... How it took place no one can explain, and anyone who would attempt to make an explanation would be going far beyond anything the Lord has told us. But a change was wrought over the whole face of the creation, which up to that time had not been subject to death. From that time henceforth all in nature was in a state of gradual dissolution until mortal death was to come, after which there would be required a restoration in a resurrected state.

President Lee's clear statement about the effects of the Fall is difficult to reconcile with the presence of ancient fossils predating man's arrival arranged in progressive complexity in the earth's strata. By way of contrast, Elder James E. Talmage of the Quorum of the Twelve, a geologist by training, expressed the following observations in a pamphlet published by the Church in 1931.<sup>182</sup>

The oldest ... rocks thus far identified in land masses reveal the fossilized remains of once living organisms, plant and animal. ... These lived and died, age after age, while the earth was yet unfit for human habitation. From the fossilized remains of plants and animals found in the rocks, the scientist points to a very definite order in the sequence of life embodiment, for older rocks, the earlier formations, reveal to us organisms of simplest structure only, whether of plants or animals. These primitive species were aquatic; land forms were of later development.

Those who, like President Lee, have made statements strongly expressing the view that no death existed on earth before the Fall should not be portrayed as intrinsically unsympathetic to science but more fundamentally as resisting any views that compromise authoritatively expressed doctrines relating to the Creation, the Fall, and the Atonement. Likewise, scientifically inclined people of faith such as Elder Talmage are not seeking to subordinate the claims of faith to the program of science but naturally desire to circumscribe their understanding of truth — the results of learning by “study and also by faith”<sup>183</sup> — into “one great whole.”<sup>184</sup>

In 1910, the First Presidency affirmed that to the extent that demonstrated scientific findings can be harmonized with “divine revelation [and] good common sense,” they are accepted “with joy.”<sup>185</sup> In this regard, Elder Lee spoke approvingly of a story recounted by LDS scientist Harvey Fletcher about President Joseph F. Smith's reply to questions posed to him at BYU about the topic of evolution.<sup>186</sup>

After listening patiently he replied: “Brethren, I don't know very much about science. It has not been my privilege to study ... deeply ... any of the sciences, but this I do know, that God lives, and that His Son instituted this church here upon the earth for the salvation of men. Now Brethren, you have that testimony, and I've heard you bear it. It's your job to try and see how these seeming difficulties can be overcome.”

#### **24. Moses 3:9: What kind of fruit grew on the “Tree of Knowledge of Good and Evil”?**

Before speaking of the fruit itself, a few observations should be made about the symbolism of the Tree of Knowledge. The Hebrew expression “knowledge of good and evil” can mean knowledge of what is good and bad, or of happiness and misery — or, most arguably, of “everything,” if “good and evil” can be taken to mean the totality of all that is, was, or is yet to be.<sup>187</sup> The kind of understanding implied by the phrase “knowledge of good and evil” is, as Claus Westermann concludes:<sup>188</sup>

concerned with knowledge (or wisdom) in the general, comprehensive sense. Any limitation of the meaning of “the knowledge of good and evil” is thereby excluded. It can mean neither moral nor sexual<sup>151</sup> nor any other partial knowledge, but only

that knowledge which includes and determines human existence as a whole, [the ability to master] ... one's own existence.

Consistent with this reading of the phrase, LDS scripture refers to the ability to know “good *from* evil,”<sup>190</sup> which presupposes “man’s power to choose the sweet even when it is harmful and reject the bitter even when beneficial.”<sup>191</sup>

LDS teachings about the nature of the “forbidden fruit” include a wide variety of opinions. For example, while President Brigham Young<sup>192</sup> and Elder James E. Talmage<sup>193</sup> understood the scriptures as describing a literal ingestion of “food” of some sort, Elder Bruce R. McConkie left the door open for a figurative interpretation: “What is meant by partaking of the fruit of the Tree of Knowledge of good and evil is that our first parents complied with whatever laws were involved so that their bodies would change from their state of paradisiacal immortality to a state of natural mortality.”<sup>194</sup>

Given the pervasiveness of the temple themes in the early chapters of Genesis, it would be surprising if temple symbolism were not somehow connected to the Tree

of Knowledge. Whether speaking of the heavenly temple or of its earthly models, the theme of access to revealed knowledge is inseparably connected with the passage through the veil.<sup>195</sup> Consistent with this general idea about the nature of the forbidden fruit, Islamic traditions insist that the reason Satan was condemned after the Fall was because he had claimed that he would reveal a knowledge of certain things to Adam and Eve.<sup>196</sup>

Hugh Nibley succinctly summed up the situation: “Satan disobeyed orders when he revealed certain secrets to Adam and Eve, not because they were not known and done in other worlds, but because he was not authorized in that time and place to convey them.”<sup>197</sup> Although Satan had “given the fruit to Adam and Eve, it was not his prerogative to do so — regardless of what had been done in other worlds. (When the time comes for such fruit, it will be given us legitimately.)”<sup>198</sup>



Figure 15: *The Great High Priest*, 2015  
Benjamin Pack, 1985-



## 25. Moses 3:9: Did the “Tree of Life” confer biological immortality on Adam and Eve?

Since the Tree of Life is not specifically prohibited to Adam and Eve, readers have often speculated on the question of whether Adam and Eve can be presumed to have eaten from it in order to prolong their lives so long as they remained in the Garden. However, a careful reading of Genesis itself seems to run counter to this view. For example, the use of the term “also” in Genesis 3:22 (Hebrew *gam*; “and take *also* of the tree of life”) suggests that they had not yet partaken of the fruit of the Tree of Life at the time these words were spoken.

Evidence for the use of *gam* in the sense of “new and additional activity” is provided in Genesis 3:6 as well (“and *also* gave to her husband”).<sup>199</sup> Additionally, Barr studied 131 cases of “lest” (Hebrew *pen*; “lest he put for his hand ... and eat”) in the Bible “and found none which means ‘lest someone continue to do what they are already doing.’”<sup>200</sup> Specifically affirming such a reading is a unique Samaritan exegesis of Genesis 2:16 that specifically excludes the Tree of Life from the original permission given to Adam and Eve to eat from the trees of the Garden.<sup>201</sup>

In contrast to the common idea that eating the fruit of the Tree of Life was merely a way to provide biological immortality, Elder Bruce R. McConkie maintained that its purpose was to confer the glory of “eternal life”<sup>202</sup> — the kind of life that God lives — in whatever degree, of course, those who partake are qualified to receive it.<sup>203</sup> Non-Mormon scholar Vos concurs, concluding that “the tree was associated with the higher, the unchangeable, the eternal life to be secured by obedience throughout the probation.”<sup>204</sup> Consistent with ancient temple imagery associated with the Garden of Eden, Adam and Eve would not have been permitted to partake of the fruit of the Tree of Life at their own discretion. Like each one of us, Adam and Eve’s only approach to the Tree of Life was by way of leaving the Garden of Eden to pass into mortality, and finally returning at last to taste of the sweet fruit only when they had progressed on their probationary journey to the point they could be authoritatively invited to do so.<sup>205</sup>



Figure 16: *The Creation of Eve*, 1510  
Michelangelo Buonarroti, 1475-1564

## 26. Moses 3:22: Was Eve created from a rib?

President Spencer W. Kimball taught that: “The story of the rib, of course, is figurative.”<sup>206</sup> As Nahum Sarna describes: “The mystery of the intimacy between husband and wife and the indispensable role that the woman ideally plays in the life of man are symbolically described in terms of her creation out of his body. The rib taken from man’s side thus connotes physical union and signifies that she is his companion and partner, ever at his side.”<sup>207</sup>

In Mesopotamian literature, Ea, the god of wisdom, is “described as ‘the ear of [the god] Ninurta’ because the ear was regarded as the seat of intelligence. In Greek mythology, Athena, the goddess of wisdom, sprang from the forehead of Zeus, the seat of the brain.”<sup>208</sup> In the Bible, by way of contrast, the use of the word rib “expresses the ultimate in proximity, intimacy, and identity.”<sup>209</sup> Writes Nibley: “The rib in Arabic is the *urka* or *silka*. It is the expression for anything as close to you as a thing can possibly be.”<sup>210</sup> Note that in the Sumerian myth of Enki and Ninhursag, Ninti is the name of a deity who cures Enki’s rib — her name meaning both “the lady of the rib” and “the lady who makes life.”<sup>211</sup>

### 27. Moses 7:21: By what means was the whole city of Zion “taken up into heaven”?

Note that scripture does not say that the “city” of Moses 7:19 was taken up into heaven. Rather, it says that “Zion, in process of time, was taken up into heaven,” meaning that its inhabitants were gradually translated.

Although some early Church leaders taught that a physical city of Zion was taken up into heaven,<sup>212</sup> it should be remembered that the primary definition of Zion is as a *people*.<sup>213</sup> When Moses 7:63 describes the return of the “city” of Zion, it speaks of the warm fellowship of affection between its heavenly and earthly inhabitants, not of a restoration of ancient buildings, streets, and gardens.

### 28. Moses 7:48: Does the fact that Enoch hears a voice from the bowels of the earth mean that it is alive?



Figure 17: Plate from *The Song of Los*, 1795  
William Blake, 1757-1827

The Book of Mormon prophet Jacob makes a clear distinction between those parts of God’s creation that act, and those that are merely acted upon.<sup>214</sup> Unlike the earth and other inanimate objects, men “are redeemed from the fall they have become free forever, knowing good from evil; to act for themselves and not to be acted upon, save it be by the punishment of the law at the great and last day.”<sup>215</sup>

The verse in question should be taken as a poetic reference to the mourning of all creation at mankind’s destructive and self-destructive tendencies.<sup>216</sup> O. Glade Hunsaker notes the beauty of the imagery:<sup>217</sup> “the poetry of Moses is striking. For example, Enoch hears and describes the personified soul of the earth alliteratively as the ‘mother of men’ agonizing from the bowels of the earth that she is ‘weary’ of ‘wickedness.’”<sup>218</sup>



The tension of the drama resolves itself as the voice uses assonance in pleading for ‘righteousness’ to ‘abide’ for a season.”

**29, Moses 8:13, 21; Genesis 6:4: What is to be understood by references to the “sons of God” in Genesis and the book of Moses? Were they divine beings that married human women?**

The term “sons of God,” as it occurs in the enigmatic episode of mismatched marriages in the Bible<sup>219</sup> and in passages in *1 Enoch*,<sup>220</sup> has been the source of no end of discussion among scholars.<sup>221</sup> Contradicting traditions that depict these husbands as fallen angels, the book of Moses and some ancient exegetes portray them as mere mortals.<sup>222</sup> Following what became the standard tradition in the Syriac Church, that saw the “sons of God” as righteous Sethites and the “daughters of men” as wicked Cainites,<sup>223</sup> Ephrem the Syrian interpreted these traditions to mean that: “[T]hose who lived on higher ground,<sup>224</sup> who were called ‘the children of God,’ left their own region and came down to take wives from the daughters of Cain down below.”<sup>225</sup> An Islamic source likewise asserts: “But one errs and misunderstands [if] he says that ‘angels’ descended to ‘mortal women.’ Instead, it is the sons of Seth who descend from the holy mountain to the daughters of Cain the accursed. For it was on account of their saintliness [chastity?] and dwelling place upon the holy mountain that the sons of Seth were called *banu ‘elohim*; that is, ‘sons of God.’”<sup>226</sup>

Modern revelation makes it clear that one can become a “son of God” through receiving the ordinances of the priesthood. Adam’s acceptance of the ordinance of baptism of the water and the Spirit is explicitly described in the book of Moses,<sup>227</sup> as are allusions to subsequent priesthood ordinances that were intended to lead him — and his posterity — to the glorious end of the pathway of exaltation. Thus, we are told that Adam was “after the order of him who was without beginning of days,” and that he was “one” in God, “a son of God.”<sup>228</sup> Through this same process — both having received every priesthood ordinance and covenant, and also having successfully completed the probationary tests of earth life — all may become sons of God.<sup>229</sup>

**30. Moses 8:30: Did God literally “destroy all flesh from off the earth” in the flood of Noah?**

Walter Bradley summarizes some of the difficulties in the idea of a universal flood:<sup>230</sup>

The terminology used in Genesis 6-9 seems to favor a global flood. ... [However, t]he use of such biblical language in other stories may help us to understand the intention here. In Genesis 41:56, we are told, “The famine was spread over all the face of the earth.” We normally interpret this famine as devastating the lands of the ancient Near East around Egypt and do not assume that American Indians and Australian Aborigines came to buy grain from Joseph. 1 Kings 10:24 states that “the whole world sought audience with Solomon to hear the wisdom God had put in his heart.” Surely Inca Indians from South America or Maoris from New Zealand had not heard of Solomon and sought his audience.



Figure 18: *The Evening of the Deluge*, ca. 1843  
Joseph Mallord William Turner, 1775-1851

The Hebrew word *eretz* used in Genesis 7:19 is usually translated “earth” or “world” but does not generally refer to the entire planet. Depending on the context, it is often translated “country” or “land” to make this clear. References to the entire planet are found in Genesis 1:1; 2:1; and 14:22, for example. However, more typical references might be Genesis 1:10; 2:11; or 2:13, where *eretz* is translated “land.” In Genesis 12:1, Abram was told to leave his *eretz*. He was obviously not told to leave the planet but rather to leave his country. ... A final helpful

comparison to obtain a proper interpretation of Genesis 7:19 involves Deuteronomy 2:25, which talks about all the nations “under the heavens” being fearful of the Israelites. Obviously, all nations “under the heavens” was not intended to mean all on planet Earth.

The Hebrew word translated “covered” in Genesis 7:19 is *kasah*. It can mean “residing upon,” “running over,” or “falling upon.” Twenty feet of water running over or falling upon the mountains (or hills) is quite different from that amount residing upon them, although either event could destroy human and animal life in its path. ...

If the entire Mesopotamian valley was flooded, and the water receded slowly, then Noah might have seen only water with distant mountain ranges over the horizon. God’s use of wind in Genesis 8:1 to cause the flood to subside would be reasonable for a local flooding of this huge valley. It would not make sense for a flood that left water to a depth of thirty thousand feet, sufficient to cover Mount Everest. Genesis 8:4 indicates that the Ark came to rest on the hills or mountains of Ararat, not specifically Mount Ararat, which is seventeen thousand feet tall. This complex mountain range extends north and east of Mount Ararat down to the foothills skirting the Mesopotamian plain. If the Ark had landed near the top of Mount Ararat, it is difficult to imagine how Noah and his family as well as the animals would have been able to descend to the base of the mountain, given the considerable difficulty mountain climbers have today in attempting to reach the locations where the Ark is thought (I believe, incorrectly) to have landed.

Further evidence for a local flood is found in Genesis 8:5, where it is noted that the water receded until the tenth month, when the tops of the mountains (or hills) became visible for the first time. The reference here seems to be what Noah could see, not the entire world.

In Genesis 8:11, the dove returns with an olive leaf. Since olive trees don’t grow at higher elevations, a flood that covered all the mountains would not give this type

of evidence of receding. One can estimate the total amount of water that would be needed to cover all the mountains on the face of the earth and compare this to the total water reserves that we know of on planet Earth in all lakes, oceans, and subterranean aquifers. A flood that covered all mountains on earth would require 4.5 times the total water resources that exist on planet Earth.

Addressing the question of the Flood, Elder John A. Widtsoe, writing in 1943, stated:<sup>231</sup>

We should remember that when inspired writers deal with historical incidents they relate that which they have seen or that which may have been told them, unless indeed the past is opened to them by revelation.

[For example, t]he details in the story of the Flood are undoubtedly drawn from the experiences of the writer. . . . The writer of Genesis made a faithful report of the facts known to him concerning the Flood. In other localities the depth of the water might have been more or less.

### 31. Genesis 6:14-16: What are we to make of the large size and strange shape of Noah's Ark?

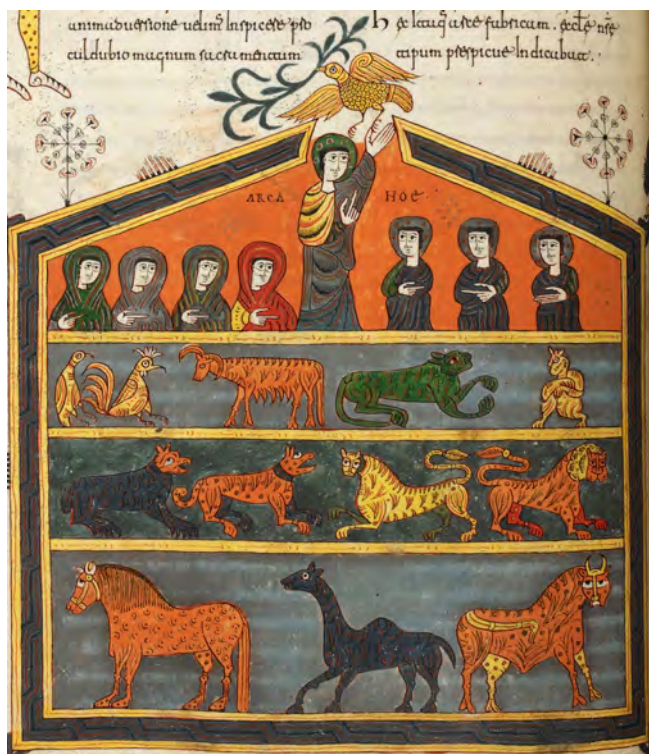


Figure 19: *The Ark and Its Occupants*, 1109, Petrus

The story of the Flood replays with significant variation many of the themes found in the earlier chapters of Genesis, including stories of a creation, a garden, and a fall.<sup>232</sup> Predictably, it also resonates with temple motifs.

It is significant that, apart from the Tabernacle of Moses<sup>233</sup> and the Temple of Solomon,<sup>234</sup> Noah's Ark is the only manmade structure mentioned in the Bible whose design was directly revealed by God.<sup>235</sup> Noah's Ark seems to have been "designed as a temple,"<sup>236</sup> specifically a prefiguration of the Tabernacle, as argued by Morales.<sup>237</sup>

The Ark's three decks suggest both the three divisions of the Tabernacle and the threefold layout of the Garden of Eden.<sup>238</sup> Indeed, each of the decks of Noah's Ark was exactly "the same height as the Tabernacle and three times the area of the Tabernacle court."<sup>239</sup> Note that Noah's Ark is shaped with a flat bottom like a box or coffer. The ratio of the width to the height of both Noah's Ark and the Ark of the Covenant is 3:5.<sup>240</sup>

The biblical account makes clear that the Ark “was not shaped like a ship, and it had no oars,” “accentuating the fact that Noah’s deliverance was not dependent on navigating skills, [but rather happened] entirely by God’s will,”<sup>241</sup> its movement solely determined by “the thrust of the water and wind.”<sup>242</sup> Likewise, whether the dimensions of the seven-storied ark (or “temple”<sup>243</sup>) in the Mesopotamian story of *Gilgamesh*<sup>244</sup> are imagined to represent the shape of “a sea-going ziggurat”<sup>245</sup> or instead a “floating *microcosm*”<sup>246</sup> in the form of a gigantic cube, the nautical improbability of such a vessel is meant to affirm the miraculous nature of the rescue in the context of temple symbolism.

### **32. Genesis 9:16: Did the first rainbow appear in the time of Noah?**

About the rainbow that betokened the covenant between God and Noah, Hugh Nibley asked:<sup>247</sup>

Why do Christians insist on calling it the first rainbow, just because it is the first mentioned? Who says that water drops did not refract light until that day? Well, my old Sunday School teacher, for one, used to say it. The rainbow, like the sunrise, is strictly the product of a point of view, for which the beholder must stand in a particular place while it is raining in another particular place and the sun is in a third particular place, if he is to see it at all. It is a lesson in relativity.

### **33. Genesis 9:19: Were there others besides Noah and his family who survived the Flood?**

Results of genetic studies seem to indicate that both the nearest common male and female ancestors of mankind lived long before Adam and Eve entered mortality<sup>248</sup> — or, for that matter, at a more distant period than Noah, whose sons traditionally have been understood to be the sole male survivors of the Flood. Some biblical scholars have studied ancient manuscripts that seem to provide support for the idea that there were “other people ‘out there’ when God created Adam and Eve, but they ... weren’t [considered to be] fully human in the sense that Adam and Eve were.”<sup>249</sup>

Drawing on the richer sources of scripture produced through modern revelation, Hugh Nibley has raised a series of questions with an eye to finding scriptural support for surviving non-Noachian lineages that might help explain such findings.<sup>250</sup> Nibley no doubt was wondering whether some of these shadowy peoples described in scripture might be neither descendants of Noah nor of Adam but rather distantly related contemporaries whose descendants may have mixed at various times with the Adamic lineage.<sup>251</sup> Of relevance is the reminder by Ryan Parr that promised blessings from patriarchs such as Abraham, Isaac, and Jacob are of necessity driven by covenant and lineal descent, not by genetics, since specific “nuclear DNA finding its way from any one of these progenitors to any descendent of today is extremely unlikely from a biological perspective.”<sup>252</sup>

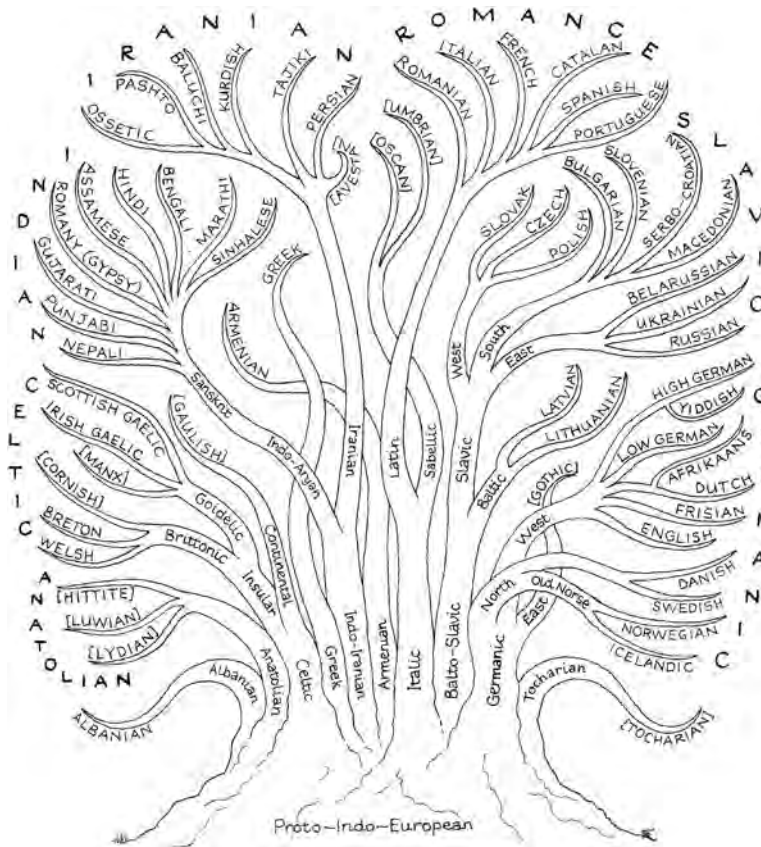


Figure 20: Family Tree of the Indo-European Languages, 2005  
Katharine Scarfe Beckett, 1972-

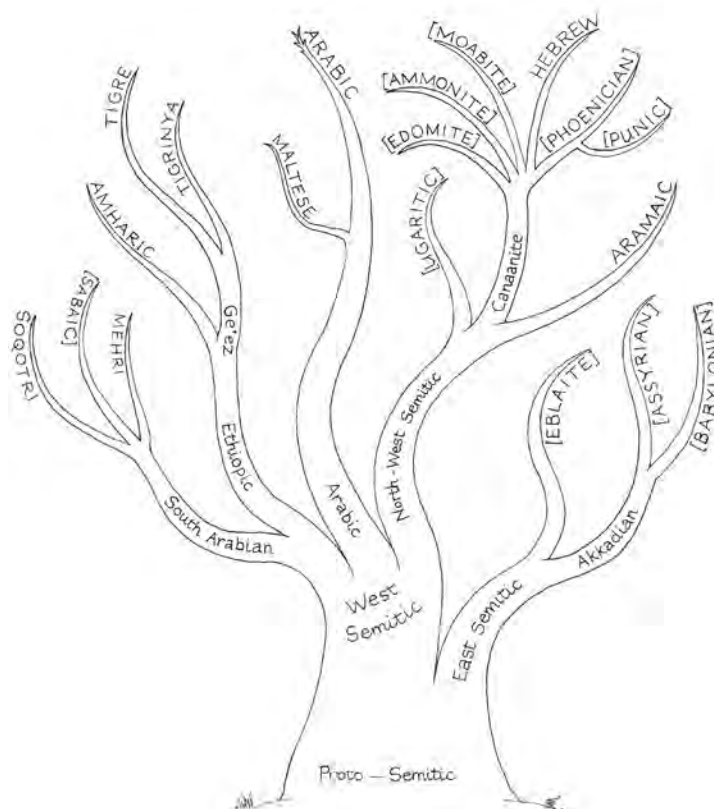


Figure 21: Family Tree of the Semitic Languages, 2005  
Katharine Scarfe Beckett, 1972-

### **34. Genesis 10:25: What does the phrase mean that says the earth was divided in the days of Peleg?**

Concerning the meaning of the statement that “the earth [was] divided,” LDS scholar B. Kent Harrison observes:<sup>253</sup> “This division ... is, of course, suggestive of continental drift,<sup>254</sup> but the time scales are all wrong. ... It has also been suggested that the splitting is only political.”<sup>255</sup> Something like the latter interpretation is suggested by the wording of the Joseph Smith Translation, which seems to posit a causal connection between Peleg’s might and the division of the earth: “Peleg was a mighty man, for in his days was the earth divided.”<sup>256</sup> Note that the description of Peleg as “a mighty man”<sup>257</sup> recalls the figure of Nimrod.<sup>258</sup>

### **35. Genesis 11:9: How are we to understand the Lord’s confounding the language of the builders of the Tower of Babel in light of historical linguistics?**

If we take the “one language” of Genesis 11:1 as being Sumerian, Akkadian, or even (as a long shot) Aramaic<sup>259</sup> rather than a supposed universal proto-language,<sup>260</sup> some of the puzzling aspects of the biblical account become more intelligible. For example, “Genesis 10 and 11 would make linguistic sense in their current sequence. In addition to the local languages of each nation,<sup>261</sup> there existed ‘one language’<sup>262</sup> which made communication possible throughout the world”<sup>263</sup> — or, perhaps more accurately, throughout the land.<sup>264</sup> “Strictly speaking, the biblical text does not refer to a plurality of languages but to the ‘destruction of language as an instrument of communication.’”<sup>265</sup>

Hamilton<sup>266</sup> presents a reasonable view when he writes that it “is unlikely that Genesis 11:1-9 can contribute much, if anything, to the origin of languages. ... [T]he diversification of languages is a slow process, not something catastrophic as Genesis 11 might indicate.”<sup>267</sup> The commonly received interpretation of Genesis 11 provides “a most incredible and naïve explanation of language diversification. If, however, the narrative refers to the dissolution of a Babylonian lingua franca, or something like that, the need to see Genesis 11:1-9 as a highly imaginative explanation of language diffusion becomes unnecessary.”<sup>268</sup>

Brant Gardner summarizes the take-home lesson of the Tower of Babel story:<sup>269</sup> “[T]he confounding of languages is related to the mixing (confounding) of different peoples in creating this great tower in Babylon. From such a mixing of people who were attempting to build a temple to the heavens, Yahweh removed some of His believers [e.g., the Jaredites] for His own purposes.”

Like the other stories in the first eleven chapters of Genesis, the story of the Tower of Babel is woven throughout with temple themes. The Tower can be seen as a sort of anti-temple wherein the Babylonians attempt to “make ... a name” for themselves.<sup>270</sup>



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- — — . 1876. “Personal revelation the basis of personal knowledge; philosophic view of Creation; apostasy involves disorganization and returns to primitive element; one man power (Discourse by Brigham Young, delivered in the New Tabernacle, Salt Lake City, Sunday Afternoon, September 17, 1876).” In *Journal of Discourses*. 26 vols. Vol. 18, 230-35. Liverpool and London, England: Latter-day Saints Book Depot, 1853-1886. Reprint, Salt Lake City, UT: Bookcraft, 1966.
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### Endnotes

1. J. E. Talmage, *Earth and Man*, p. 244.
2. A similar view is eloquently echoed and elaborated by John H. Walton, a well-respected scholar of Genesis who takes the divinely inspired nature of the Bible seriously (J. H. Walton, *Lost World of Adam and Eve*, pp. 17, 18-19, 21):

[W]e are obliged to respect the text [of the Bible] by recognizing the sort of text that it is and the nature of the message that it offers. In that regard, we have long recognized that the Bible is not a scientific textbook. That is,

God's intention is not to teach science or to reveal science. He *does* reveal His work in the world, but He *doesn't* reveal how the world works. ...

[T]he authority of the text is not respected when statements in the Bible that are part of ancient science are used as if they are God's descriptions of modern scientific understanding. When the text talks about thinking with our hearts or intestines, it is not proposing scientific ideas that we must confirm if we wish to take biblical authority seriously. ... This is simply communications in the context of ancient science. In the same way, when the text talks about the water below the vault and the water above the vault (Genesis 1:6) we do not have to construct a cosmic system that has waters above and waters below. Everyone in the ancient world believed there were waters above because when it rained water came down. ...

Every aspect of the regular operations of the world as described in the Bible reflects the perspectives and ideas of the ancient world — ideas that Israel along with everyone else in the ancient world already believed. Though the text has much revelation to offer about the nature of God and his character and work, there is not a single incidence of new information being offered by God to the Israelites about the regular operation of the world (what we would call natural science). The text is thoroughly ancient and communicates in that context.

That said, we should allow our interpretation of scripture to benefit from whatever sort of sound perspective we can bring to it — whether scientific, cultural, historical, or spiritual — so long as such perspectives do not inhibit the text from speaking for itself (*ibid.*, p. 14):

We are not compelled to bring the Bible into conformity either with its cultural context or with modern science, but if an interpretation of Genesis, for example, coincides with what seem to be sound scientific conclusions, all the better. Even in a Bible-first approach (in contrast to a science-first or even extrabiblical-first approach), we can be attentive to the ancient world or to modern science without compromising our convictions about the Bible. Either information from the literature of the ancient world or new insights from scientific investigation may appropriately prompt us to go back to the Bible to reconsider our interpretations. This does not mean that we blindly force the text to conform to demand from other fields. The Bible must retain its autonomy and speak for itself. But that is also true when we hold traditional interpretations up to the Bible. The biblical text must retain its autonomy from tradition. We must always be willing to return to the text and consider it with fresh eyes.

3. W. G. Dever, *Artifacts*, p. 5, cited in B. A. Gardner, *Traditions*, p. 36.

4. 1 Nephi 2:10, 20, 22; 3:5, 7, 16, 21; 4:1, 11, 14-15, 17, 34; 5:20-21; 6:6; 8:38; 9:3; 15:10-11, 25; 16:4, 8; 17:3, 13, 15, 22; 19:3-4; 20:18; 22:30; 22:31; 2 Nephi 1:7, 9-10, 20, 24, 32; 2:21, 26, 28; 3:2, 7-8; 4:4; 5:10, 19, 31; 9:27; 25:25; 26:10; 30:1, 31:7, 10, 14, 18.

5. R. S. Hendel, *Demigods*, p. 23. See J. M. Bradshaw and D. J. Larsen, *God's Image 2*, OVERVIEW Genesis 11, p. 379. See also the discussion by Hendel of Genesis 6:1-4 in H. W. Attridge et al., *HarperCollins Study Bible*, p. 13, where he specifically includes the Garden of Eden, the mating of the sons of God with the daughters of men, and the Tower of Babel as examples of such transgressions in Genesis 1-11.
6. D. M. Carr, *Reading*, p. 239.
7. T. N. D. Mettinger, *Eden*, p. 127.
8. R. A. Oden, Jr., Divine aspirations in Atrahasis and in Genesis 1-11, pp. 211, 215.
9. See J. M. Bradshaw and D. J. Larsen, *God's Image 2*, ENDNOTE 0-4, p. 24.
10. Regarding the application of this phrase to Enoch and his people, see Moses 6:39, 7:69. Regarding Noah and his sons, see Moses 8:27. In addition, Abraham is commanded by the Lord to "walk before me" in Genesis 17:1, and Isaac speaks of "The Lord, before whom I walk" in Genesis 24:40. About possible reasons for the overlap and confusion between the characters of Noah, Enoch, and other patriarchs in the ancient literature, see H. W. Nibley, *Enoch*, pp. 22-55.
11. See, e.g., the discussion in J. M. Bradshaw, *God's Image 1*, pp. 234-240. For a preliminary discussion of these contrasting themes, see *ibid.*, pp. 342-351. On the Flood in the context of purification, see E. A. Harper, *It's a Washout*; L. M. Morales, *Tabernacle Pre-Figured*, pp. 128-129.
12. For a more complete discussion of the book of Moses as a temple text, see J. M. Bradshaw, *LDS Book of Enoch*. Demonstrating how far careful scripture readers of other faiths have come in recognizing the importance of temple-related ideas in providing and guiding the context of interpretation for the Old and New Testaments, the eminent theologian N. T. Wright asserts (in J. H. Walton, *Lost World of Adam and Eve*, p. 175):
 

One of the great gains of biblical scholarship this last generation, not least because of our new understanding of first-temple Judaism, is our realization that the temple was central to the Jewish worldview.
13. Articles of Faith 1:8. In this connection, President Gordon B. Hinckley wrote (G. B. Hinckley, *Great Things*, p. 81):

The Christian world accepts the Bible as the word of God. Most have no idea of how it came to us.

I have just completed reading a newly published book by a renowned scholar. It is apparent from information which he gives that the various books of the Bible were brought together in what appears to have been an unsystematic fashion. In some cases, the writings were not produced until long after the events they describe. One is led to ask, "Is the Bible true? Is it really the word of God?"

We reply that it is, insofar as it is translated correctly. The hand of the Lord was in its making.

14. Walton and Sandy, *Lost World of Scripture*, pp. 68, 69. With respect to Genesis in particular, “it is fairly obvious that the book of Genesis serves as a kind of introduction or prologue to what follows in Exodus through Deuteronomy” (ibid., p. 29). “Nevertheless,” continues Schmid in his highlighting of one prominent theme in the most recent thinking on the topic (ibid., pp. 30, 32, 45):

the function of Genesis to the Pentateuch is apparently not exhausted by describing it as an introduction to the Moses story. ... Genesis ... shows ... clear signs of having existed as a stand-alone literary unit for some portion of its literary growth. Genesis is a special book within the Pentateuch: it is the most self-sufficient one. ... In current scholarship, it is no longer possible to explain the composition of the book of Genesis from the outset within the framework of the Documentary Hypothesis.

15. *American Heritage Dictionary*. The definition adds: “but composed within approximately 200 years of the birth of Jesus Christ.” This is a typical criterion for inclusion in modern collections of pseudepigrapha.
16. Walton and Sandy, *Lost World of Scripture*, p. 305.
17. It should be noted that many scholars see Daniel as a fictional character.
18. In a footnote, Walton refers to Craig Blomberg’s term: “benign pseudonymity.”
19. For a brief overview of the background of the JST and its relationship to the book of Moses, see J. M. Bradshaw, *God’s Image 1*, pp. 1–9.
20. P. L. Barlow, *Bible* (2013), pp. 55–57.
21. Ben McGuire cautions against the adoption of extremes at either end of the spectrum with respect to translation issues (personal communication):

On the one end of the spectrum we could (as believers) hold to a view in which [the Books of Moses and Abraham] are modern pseudepigrapha—a notion which contradicts what appears to be the opinion of the text held by Joseph Smith and his contemporaries (and this makes us appropriately uncomfortable...). On the other end, the view that they are wholly revealed translations of ancient texts seems, at least on the surface, to be unsupportable.

22. P. L. Barlow, *Bible* (2013), p. 57.
23. For numerous examples, see J. M. Bradshaw, *God’s Image 1* and J. M. Bradshaw and D. J. Larsen, *God’s Image 2*.
24. H. M. Smith et al., *Commentary*, p. 350.

25. Compare Gardner's analysis of Book of Mormon usage of the name/title "Jesus Christ" (Gardner, *Gift and Power*, pp. 241–242). For more on this issue, see the discussion of Moses 6–7 below. Note that acceptance of the general primacy of conceptual rather than literal equivalence in translation undercuts one of the primary tools of the textual critic, i.e., vocabulary analysis (*ibid.*, pp. 233–239).
26. J. Smith, Jr., *Documentary History*, 27 November 1832, 1:299.
27. R. J. Matthews, *Plainer*, p. 215.
28. For example, Bachman has argued convincingly that most of the substance of D&C 132 was revealed to the Prophet as he worked on the first half of JST Genesis (D. W. Bachman, *New Light*). This was more than a decade before 1843, when the revelation was shared with Joseph Smith's close associates.
29. J. Smith, Jr., *Writings 2002*, 31 July 1832, p. 273.
30. Moses 1:43. See also Moses 4:32: "See thou show them unto no man, until I command you, except to them that believe."
31. The quoted words are from Mormon Apostle George Q. Cannon's remembrance (G. Q. Cannon, *Life [1907]*, p. 129 n.): "We have heard President Brigham Young state that the Prophet before his death had spoken to him about going through the translation of the scriptures again and perfecting it upon points of doctrine which the Lord had restrained him from giving in plainness and fulness at the time of which we write."

This is consistent with George Q. Cannon's statement about the Prophet's intentions to "seal up" the work for "a later day" after he completed the main work of Bible translation on 2 February 1833 (*ibid.*, p. 129):

No endeavor was made at that time to print the work. It was sealed up with the expectation that it would be brought forth at a later day with other of the scriptures [see D&C 42:56–58]. ... [T]he labor was its own reward, bringing in the performance a special blessing of broadened comprehension to the Prophet and a general blessing of enlightenment to the people through his subsequent teachings.

I have elsewhere argued the likelihood that the focus of the divine tutorial that took place during Joseph Smith's Bible translation effort was on temple and priesthood matters — hence the restriction on general dissemination of these teachings during the Prophet's early ministry.

32. For more detailed discussion of these verses, see J. M. Bradshaw, *God's Image 1*; J. M. Bradshaw and David J. Larsen, *God's Image 2*.
33. Moses 1:37–39.
34. D&C 76:23–24.

35. J. Smith, Jr. (or W. W. Phelps), *A Vision*, 1 February 1843, stanzas 19-20, cited in L. E. Dahl, *Vision*, p. 298.
36. N. A. Maxwell, *How Choice*, p. 100.
37. Moses 1:33; D&C 76:24.
38. See the J. M. Bradshaw, *God's Image 1*, overview of Moses 2, p. 84 and COMMENTARY 2:5-e, p. 103.
39. E. W. Tullidge, *Women*, p. 178
40. See <http://www.dhbailey.com>.
41. For examples of views from Mormon scholars and scientists, see <http://mormonscholarstestify.org/>.
42. Erroneously inferred from Psalm 33:6, 9 and 2 Esdras 6:38.
43. S. Sandmel et al., *New English Bible*, 7:28, p. 243.
44. N. M. Sarna, *Genesis*, p. 5.
45. J. Smith, Jr., *Teachings*, 5 January 1841, p. 181, consistent with Abraham 4:1.
46. *Ibid.*, 7 April 1844, pp. 350-351.
47. K. L. Barney, *Six*, pp. 108-112. See also H. R. Johnson, *Big Bang*; K. E. Norman, *Ex Nihilo*; B. T. Ostler, *Nothing*; S. D. Ricks, *Ex Nihilo*. "The primary transition is not from nothingness to being but from chaos to order" (T. L. Brodie, *Dialogue*, p. 133). Consistent with this biblical perspective, Teppo describes the "central theme" of the Mesopotamian creation account, *Enuma Elish*, as being "organizing, putting things in their correct places" (S. Teppo, *Sacred Marriage*, p. 90).
48. R. D. Draper et al., *Commentary*, p. 193.
49. Moses 2:14-19. See, e.g., F. B. Salisbury, *Creation*, p. 71.
50. H. W. Nibley, *Before Adam*, p. 69.
51. J. Taylor, 31 December 1876, p. 327.
52. See D&C 88:7-9. See 1 John 1:5; cf. Psalm 104:2.
53. Cf. Psalm 36:9.
54. I. Watts, *Hymns*, *God, my only Happiness* (Psalm 73:25), 2:94, p. 432.
55. See, e.g., J. L. Kugel, *Instances*, pp. 157-160.

56. J. Neusner, *Genesis Rabbah 1*, 3:4, p. 29; cf. Psalm 104:2. Note that the darkness mentioned in Moses 2:2 (“I caused darkness to come up upon the face of the deep”) seems to be entirely without negative connotation. On the contrary, according to Wyatt’s brilliant exposition of related Ugaritic and OT passages (N. Wyatt, *Darkness*, pp. 95-96, 97), the:

passage paradoxically makes darkness the locus of the invisibility, and therefore perhaps of the spiritual essence, of the deity. Furthermore, it links darkness explicitly with the waters, and, I suspect, with the primordial waters in mind, as the extraterrestrial location of God. Indeed, the chiastic structure of the bicolon cleverly envelops the dwelling (str, skh) in the darkness and the darkness of the waters, a graphical verbal presentation of the secrecy of the divine abode. ...

This process involves the initial stages in the self-manifestation of the deity. It is, in somewhat unusual form, an account of a theophany. It describes three stages in it: first, there is the seemingly improbable condition of primordial chaos in which it is to occur [*thw wbhwh*]. Secondly, there is the inchoate medium of revelation: the darkness. And thirdly, there is the spirit of God intuited rather than seen traversing waters as yet unordered.

57. M. Barker, *Revelation*, p. 22; cf. H. W. Nibley, *Message 2005*, pp. 440-441.
58. 1 Timothy 6:16.
59. John 17:5.
60. H. Koester et al., *Thomas*, 50, p. 132.
61. Cf. Abraham 4:5, 8, 13, ff.
62. U. Cassuto, *Adam to Noah*, pp. 28-30; N. M. Sarna, *Genesis*, p. 8.
63. U. Cassuto, *Adam to Noah*, p. 28.
64. Ephesians 1:10; D&C 27:13; 128:18.
65. M. Barker, *Temple Theology*, pp. 24-25. See also P. H. Reardon, *Reflections*, pp. 32-33.
66. E.g., Isaiah 2:12; 13:5, 9; Jeremiah 46:10; Ezekiel 13:5; Amos 5:18, 20.
67. W. Bradley, *Why*, p. 168.
68. Alma 40:8; B. R. McConkie, *Christ and the Creation*, p. 11; B. Young, 17 September 1876, p. 231; R. M. Nelson, *Creation*.
69. C. Roy, *Liquide*.
70. M. Zlotowitz et al., *Bereishis*, p. 38. See D. Kimhi’s commentary on Genesis, excerpted in E. Munk, *Hachut*.



71. Moses 2:10.
72. See M. Maimonides, *Guide*, 2:30, 2:352-353.
73. Moses 2:8.
74. H. N. Bialik et al., *Legends*, 18, p. 9; J. Neusner, *Genesis Rabbah 1*, 4:7, p. 43; cf. J. Hirschman, Baraita, p. 6.
75. B. R. McConkie, *Christ and the Creation*, p. 11; R. M. Nelson, *Creation*.
76. L. Ginzberg, *Legends*, 1:51. See also J. M. Bradshaw, *Tree of Knowledge*.
77. P. L. Barlow, *Bible*, p. 70.
78. J. Seixas, *Manual*, p. 21.
79. N. M. Sarna, *Genesis*, p. 8.
80. Helaman 12:7-8.
81. N. Webster, *Dictionary*, s.v. obey.
82. See Moses 2:12.
83. B. K. Packer, *Pattern*, p. 289.
84. J. Smith, Jr., *Words*, 20 March 1842, p. 107.
85. See Natural Kinds for a good summary of issues in relating the concept of natural kinds to the idea of species in biology.
86. H. W. Nibley, *Before Adam*, p. 70.
87. E. A. Speiser, *Creation Epic*, 1:75, p. 61.
88. See V. Hurowitz, *I Have Built*, pp. 95, 330-331.
89. J. H. Walton, *Lost World*, pp. 84, 88; J. H. Walton, *Genesis 1*, pp. 116-118.
90. J. H. Walton, *Genesis 1*, p. 115.
91. See J. M. Bradshaw et al., *God's Image 2*, ENDNOTE M8-18, p. 246.
92. J. M. Bradshaw, *God's Image 1*, p. 538.
93. *Ibid.*, COMMENTARY Moses 2:1-f, pp. 94-95.
94. J. H. Walton, *Lost World*, pp. 72-73, 75; J. H. Walton, *Genesis 1*, pp. 116-117, 178-184.
95. See e.g., Revelation 21:1.

96. Cited in C. R. Harrell, *Preexistence*, p. 20. This article contains additional discussion of approaches to interpreting the term “spiritual creation” as described in the early revelations of Joseph Smith.
97. See, e.g., citations in J. M. Bradshaw, *God’s Image 1*, EXCURSUS 8: The Origin and Premortal Existence of Human Spirits, p. 540.
98. K. W. Godfrey, *Intelligence*; P. N. Hyde, *Intelligences*. See also J. M. Bradshaw, *God’s Image 1*, EXCURSUS 8: The Origin and Premortal Existence of Human Spirits, p. 540.
99. Moses 3:5. See J. M. Bradshaw, *God’s Image 1*, ENDNOTE 3-14, p. 200.
100. Moses 3:6. See chapter in this volume that contains selected statements about the origin of man.
101. Abraham 5:7; cf. J. Smith, Jr., *Teachings*, 17 May 1843, p. 301. This idea does not imply that Mormons need accept the traditional form of philosophical dualism (personal communication from James E. Faulconer).
102. Job 38:4, 7.
103. O. S. Wintermute, *Jubilees*, 2:2, p. 55.
104. J. F. Smith, Jr., *Answers*, 1966, 5:182-184; cf. J. Smith, Jr., *Teachings*, 2 May 1844, p. 365. See also J. M. Bradshaw, *God’s Image 1*, Commentary 2:2-b, p. 99, 2:4-c, p. 101, 3:1-b, p. 151, Excursus 8: The Origin and Premortal Existence of Human Spirits, p. 540.
105. J. Smith, Jr., *Teachings*, 9 October 1843, p. 325.
106. D&C 138:38-39; Abraham 3:22-23; S. W. Kimball, *Righteous Women*, p. 102; J. Smith, Jr., *Words*, 12 May 1844, p. 371; J. Smith, Jr., *Teachings*, 12 May 1844, p. 365.
107. V. P. Hamilton, *Genesis 1-17*, p. 155.
108. R. J. V. Hiebert, *Septuagint*, p. 2.
109. N. M. Sarna, *Genesis*, p. 17.
110. J. M. Bradshaw, *God’s Image 1*, Commentary 3:10-a, p. 170.
111. Cf. JST Genesis 13:10; U. Cassuto, *Documentary*, p. 104.
112. N. M. Sarna, *Genesis*, p. 17; contrast C. Westermann, *Genesis 1-11*, pp. 203-207. See also J. M. Bradshaw, *God’s Image 1*, COMMENTARY 3:7-c, p. 157.
113. Moses 3:7.
114. Moses 3:9.

115. Moses 3:19.
116. See discussion in J. M. Bradshaw, *God's Image 1*, ENDNOTE 3-10, p. 199.
117. See, e.g., J. F. Smith, Jr., *Doctrines*, 15 February 1941, 1:62.
118. D&C 131:7.
119. Cf. J. F. Smith et al., *Origin*, 4:203-205.
120. As an apostle, Elder Joseph Fielding Smith, Jr. taught that we “were all mature spirits before we were born” (J. F. Smith, Jr., *Doctrines of Salvation*, 2:54), so it is apparent that when a child is born the mature spirit must accommodate an infant body.

Likewise, in the resurrection, “the child that was buried in its infancy will come up in the form of the child that it was when it was laid down; then it will begin to develop. From the day of the resurrection, the body will develop until it reaches the full measure of the stature of its spirit, whether it be male or female” (J. F. Smith, *Gospel Doctrine*, 1906-1907, p. 24. Cf. *ibid.*, pp. 453-457; J. Smith, Jr., *Words*, Wilford Woodruff Journal, 7 April 1844, p. 347; Thomas Bullock Report, 12 May 1844, p. 269).

In addition, President Joseph F. Smith taught that the way a spirit appears to human view is conditioned by circumstances: “If you see one of your children that has passed away it may appear to you in the form in which you would recognize it, the form of childhood; but if it came to you as a messenger bearing some important truth, it would perhaps come ... in the stature of full-grown manhood” (J. F. Smith, *Gospel Doctrine*, 1918, p. 455).

121. The first definition of “beast” in Noah Webster’s 1828 *Dictionary* is: “Any four-footed animal, which may be used for labor, food, or sport; distinguished from fowls, insects, fishes, and man; as beasts of burden, beasts of the chase, beasts of the forest. It is usually applied to large animals” (N. Webster, *Dictionary*, s. v. beast). Genesis 1:24 makes somewhat different and finer distinctions as it describes three categories of “living creatures”: “cattle, that is, living creatures whom man can domesticate or tame; creeping things, to wit, small creatures that creep about on the ground, or even big animals that have no legs, or have very short legs, so that they appear to be walking on their bellies; beasts of the earth: four-legged creatures that can never be domesticated or tamed” (U. Cassuto, *Adam to Noah*, p. 54).

With respect to the word “creature,” it should be noted that while the current meaning encompasses both animals and people, the archaic sense derived from the Latin is more general, signifying “anything that has been created.” However, with one exception, every usage in the Book of Mormon and Doctrine and Covenants refers to people (e.g., “preach the gospel to every creature” (Mormon 9:22); “justice claimeth the creature” (Alma 42:22)). Significantly,

the sole exception to this rule uses the word in the archaic sense: “that the church may stand independent above all other creatures,” the context implying that the Church itself is a “creature” (i.e., a creation) since it was created by God (D&C 78:14).

122. T. D. Stephens et al., *Evolution*, p. 124.
123. B. Young, 23 March 1856, p. 277.
124. See also J. M. Bradshaw, *God’s Image 1*, COMMENTARY 2:20-a, p. 109 and 3:7-e, p. 159; Moses 7:48.
125. Moses 2:20-25, 3:19; Abraham 4:24-25, 5:20. Cf. Rashi, *Genesis Commentary*, p. 13.
126. E.g., R. O. Cowan, *Answers*, p. 94; O. Pratt, 12 November 1879, p. 200; B. H. Roberts, *The Truth*, pp. 289-296; E. N. Skousen, *Earth*, pp. 298-302.
127. See, e.g., citations in J. M. Bradshaw, *God’s Image 1*, COMMENTARY 2:26-a, p. 111.
128. E.g., O. Pratt, 12 November 1879, pp. 200-201.
129. R. D. Draper et al., *Commentary*, p. 223; cf. Moses 3:5. See J. M. Bradshaw, *God’s Image 1*, ENDNOTE 3-56, p. 210.
130. E.g., 2 Nephi 4:34; 28:31; Jeremiah 17:5; Isaiah 40:6; 1 Nephi 22:23; Galatians 5:19; 1 John 2:16. A notable exception is a mention of the resurrected body of Christ in Luke 24:39. See R. J. Matthews, *Fall*, pp. 47-48.
131. J. F. Smith, Jr., *Origin*, p. 328.
132. J. M. Bradshaw, *Tree of Knowledge*.
133. J. H. Sailhamer, *Genesis*, pp. 41-42; T. Stordalen, *Echoes*, pp. 267-268.
134. See J. M. Bradshaw, *God’s Image 1*, Commentary 4:14-c, p. 259.
135. Moses 4:31.
136. Moses 5:41.
137. Genesis 11:2.
138. Genesis 13:11.
139. J. H. Sailhamer, *Genesis*, p. 59 and Genesis 14:17-20.
140. T. L. Brodie, *Dialogue*, p. 117.
141. Matthew 2:1. For more on the symbolism of this event, see J. M. Bradshaw, *Adam, Eve, Three Wise Men*.

142. S. C. Malan, *Adam and Eve*, 1:1, p. 1. Eastward orientation is not only associated with the rising sun, but also with its passage from east to west as a metaphor for time (N. Wyatt, *Space*, pp. 35-52). The Hebrew phrase *mi-kedem* ('in the east') in the Genesis account could also be translated "in the beginning" or "in primeval times" (T. Stordalen, *Echoes*, pp. 261-270; cf. Habakkuk 1:12). Likewise, for the Egyptians, the West, the direction of sunset, was the land of the dead — hence the many tombs built on the west bank of the Nile.
143. E. S. Drower, *Mandaeans*, p. 56; E. Lupieri, *Mandaeans*, p. 128.
144. J. S. Major, *Heaven*, p. 156.
145. T. Stordalen, *Echoes*, pp. 285-286.
146. *Ibid.*, pp. 285-286.
147. See P. Alexander, 3 Enoch, 5:5, p. 260. See J. M. Bradshaw, *God's Image 1*, ENDNOTE 3-57, p. 210.
148. H. W. Nibley, *Message 2005*, pp. 294-295. See also H. W. Nibley, *Teachings of the PGP*, 16, pp. 198-199.
149. Siegfried Schott, cited in H. W. Nibley, *Teachings of the PGP*, 16, p. 199.
150. Shelemon, *Book of the Bee*, 15, p. 20.
151. R. D. Draper et al., *Commentary*, p. 227.
152. E.g., J. F. Smith, Jr., *Doctrines*, October 1928, 1:73-74.
153. See J. M. Bradshaw, *God's Image 1*, ENDNOTE 3-31, p. 203.
154. See *ibid.*, ENDNOTE 3-32, p. 203.
155. See *ibid.*, ENDNOTE 3-33, p. 204.
156. Cf. S. D. Ricks, Adam's Fall, pp. 598-599; S. E. Robinson, Book of Adam, p. 141; O. S. Wintermute, Jubilees, 3:9, p. 59.
157. The fifteenth-century Creation and Fall speaks of Adam having been created from the "common earth" rather than the "earth of Paradise" where he was later placed (M. Herbert et al., *Irish Apocrypha*, p. 3).
158. Cf. M. Zlotowitz et al., *Bereishis*, p. 94.
159. J. Taylor, *Mediation*, 1882, pp. 75-78.
160. H. L. Andrus, *God*, p. 381 n. 88. See J. M. Bradshaw, *God's Image 1*, ENDNOTE 3-34, p. 204.
161. See J. M. Bradshaw, *God's Image 1*, ENDNOTE 3-35, p. 204.

162. See *ibid.*, pp. 142-144.
163. J. F. McConkie, *Eden*, pp. 29, 35.
164. J. E. Faulconer, *Incarnation*, p. 48. See J. S. Tanner, *World and Word*, pp. 226-230; M. Barker, *Christmas*, pp. 29-30. Regarding types and shadows, see, e.g., Mosiah 3:15. See also J. M. Bradshaw, *God's Image 1*, ENDNOTE 3-47, p. 208; J. M. Bradshaw et al., *God's Image 2*, pp. 8-12.
165. Cf. H. W. Nibley, *Treasures*, pp. 179-180; H. W. Nibley, *Teachings of the PGP*, 16, p. 203; J. M. Bradshaw, *God's Image 1*, EXCURSUS 13: Some Perspectives on Historicity, p. 552.
166. For specific references, see J. M. Bradshaw, *God's Image 1*, ENDNOTE 3-24, p. 202.
167. For specific references, see *ibid.*, ENDNOTE 3-25, p. 202.
168. For specific references, see *ibid.*, ENDNOTE 3-26, p. 202.
169. Abraham 3:9, 16.
170. See also J. Smith, Jr., *Words*, 9 March 1841, pp. 64-65.
171. See J. M. Bradshaw, *God's Image 1*, EXCURSUS 18: Kolob, p. 565 and EXCURSUS 19: "If You Could Hie to Kolob," p. 566.
172. See *ibid.*, ENDNOTE 3-27, p. 203.
173. H. L. Andrus, *God*, pp. 314-315.
174. H. K. Hansen, *Astronomy*, p. 188.
175. 2 Nephi 2:22.
176. T. D. Stephens et al., *Evolution*, p. 135. See D. Boyce, *Of Science*, pp. 200-203 for a rebuttal of this view.
177. R. W. Clayton, *Questions*.
178. Moses 3:7, 9, 19. See J. M. Bradshaw, *God's Image 1*, Endnote 3-12, p. 200.
179. See J. F. Smith, Jr., *Doctrines*, 1954, 1:76.
180. See J. M. Bradshaw, *God's Image 1*, Endnote 3-28, p. 203.
181. H. B. Lee, *Teachings 2000*, 23 June 1954, p. 20.
182. J. E. Talmage, *Earth and Man*, p. 242. See J. M. Bradshaw, *God's Image 1*, Endnote 3-29, p. 203.
183. D&C 88:118.

184. H. W. Hunter, *Teachings* 1997, 30 August 1984, p. 182.
185. J. F. Smith et al., *Words in Season*.
186. H. B. Lee, *Teachings* 1996, 6 June 1953, p. 340. See also H. B. Lee, *Place*.
187. See D&C 93:24.
188. C. Westermann, *Genesis 1-11*, pp. 247-248; cf. T. N. D. Mettinger, *Eden*, pp. 61-63.
189. Sarna writes: "Against the interpretation that [the fruit represented carnal knowledge] is the fact ... that sexual differentiation is made by God Himself [Moses 2:27], that the institution of marriage is looked upon ... as part of the divinely ordained order [Moses 2:25], and that ... 'knowledge of good and bad' is a divine characteristic" (N. M. Sarna, *Genesis*, p. 19; see Moses 4:11, 28). Westermann concurs, concluding that the opening of the eyes experienced by Adam and Eve in Moses 4:13 "does not mean that they become conscious of sexuality" (C. Westermann, *Genesis 1-11*, p. 251). It is later, immediately following the account of their expulsion from Eden, that we are given the significant detail that "Adam knew his wife, and she bare unto him sons and daughters" (Moses 5:2. See J. E. Talmage, *Jesus the Christ*, p. 30).
190. In contrast to the Bible, which exclusively employs the term "good and evil," (Genesis 2:9, 17; Genesis 3:5, 22; Deuteronomy 1:39; 2 Samuel 19:35; Proverbs 31:12; Isaiah 5:20; Jeremiah 24:3; Amos 5:14; Matthew 12:35; Luke 6:45; Hebrews 5:14; cf. 2 Nephi 2:18, 15:20; Alma 29:5, 42:3; Moses 3:9, 17; Moses 4:11, 28; Moses 5:11; Abraham 5:9, 13; JS-H 1:33), the Book of Mormon and the book of Moses contain nine instances of the similar phrase "good from evil" (2 Nephi 2:5, 26; Alma 12:31, 29:5; Helaman 14:31; Moroni 7:15-16, 19; Moses 6:56). Though, admittedly, the difference in connotation between these terms is not entirely consistent across all scriptural references to them (see e.g., Alma 12:31 and Moses 4:28), one might still argue for a distinction between the knowledge Adam and Eve attempted to acquire when they determined to eat the forbidden fruit (and would eventually receive in its fullness when they had successfully finished their probation), and that which they gained later through the experience of repeated choice in a fallen world. Unlike the former attempt to gain knowledge that had come in response to Satan's deception and as the result of moral autonomy exercised in transgression of divine instruction, the essential knowledge attained gradually by Adam and Eve during their later period of mortal probation would depend on their hearkening to the "Spirit of Christ" (Moroni 7:16, 19), mercifully made available to them through the power of redemption (2 Nephi 2:26), and enabling them to "know good from evil ... with a perfect knowledge, as the daylight is from the dark night" (Moroni 7:15).
191. A. Cohen, *Chumash*, p. 10.

192. B. Young, 8 October 1854, p. 98. President Young taught that Adam and Eve “partook of the fruit of the Earth, until their systems were charged with the nature of Earth.”
193. J. E. Talmage, *Jesus the Christ*, p. 19. Elder Talmage describes Eve’s transgression as “indulgence in food unsuited to [her] nature.”
194. B. R. McConkie, *Sermons*, p. 189.
195. J. M. Bradshaw, *Tree of Knowledge*.
196. G. Weil, *Legends*, pp. 26, 30.
197. H. W. Nibley, *Return*, 63.
198. H. W. Nibley, *Gifts*, 92.
199. V. P. Hamilton, *Genesis 1-17*, p. 209. See also T. N. D. Mettinger, *Eden*, p. 20.
200. T. Stordalen, *Echoes*, pp. 230-231. However, slightly weakening Barr’s claim, there are two exceptions among the 131 instances: Exodus 1:9 and 2 Samuel 12:27.
201. S. Lowy, *Principles*, p. 403.
202. B. R. McConkie, *New Witness*, p. 86; cf. A. Gileadi, *Studies*, p. 10; B. C. Hafen, *Broken*, p. 30.
203. D&C 88:28-32; R. J. Matthews, *Probationary Nature*, p. 56.
204. Cited in V. P. Hamilton, *Genesis 1-17*, p. 209 n. 6.
205. D&C 88:68. The vision of Lehi witnesses that it is possible to “taste” of this fruit in mortal life. Elder David A. Bednar observes: “Pressing forward to and partaking of the fruit of the tree [2 Nephi 31:17] may represent the receiving of additional ordinances and covenants whereby the Atonement can become fully efficacious in our lives” (D. A. Bednar, *Power to Become*, p. 77). However, the “tasting” that Lehi describes does not assure exaltation, since some, “after they had tasted of the fruit ... were ashamed ... and ... fell away” (1 Nephi 8:28).
206. S. W. Kimball, *Blessings*, p. 71.
207. N. M. Sarna, *Genesis*, p. 22.
208. *Ibid.*, p. 22.
209. H. W. Nibley, *Patriarchy*, p. 87.
210. H. W. Nibley, *Teachings of the PGP*, 18, pp. 229-230.
211. G. Greenberg, *Myths*, p. 55. See J. M. Bradshaw, *God’s Image 1*, COMMENTARY 4:26-a, p. 273.
212. See W. Mace, *Autobiography*; C. L. Walker, *Diary*, 10 March 1881, 2:540; E. R. Snow, *Address to Earth*; B. Young, 20 April 1856, p. 320; W. Woodruff, *Life*,



- 1867, p. 448; O. Pratt, 19 July 1874, p. 147. For a discussion of these and related cosmological ideas in early Mormon thought, see E. R. Paul, *Science*, pp. 75-126.
213. Moses 7:18-19. This accords with the third definition of “city” in Webster’s 1828 dictionary as: “The collective body of citizens, or the inhabitants of a city; as when we say, the *city* voted to establish a market, and the *city* repealed the vote” (N. Webster, *Dictionary*, s.v. city, p. 38). The *Online Etymological Dictionary* (<http://etymonline.com>) comments on the evolution of the original meaning of the term: “The sense [of city] has been transferred from the inhabitants to the place. The Latin word for “city” was *urbs*, but a resident was *civis*. *Civitas* seems to have replaced *urbs* as Rome (the ultimate *urbs*) lost its prestige.”
214. 2 Nephi 2:13-14.
215. 2 Nephi 2:26.
216. For an extended discussion of the weeping of the heavens and the mourning of the earth in the vision of Enoch, see J. M. Bradshaw et al., *Revisiting*.
217. O. G. Hunsaker, *Literature*.
218. Earlier in the verse, the term “Wo, wo” introduces the same alliteration.
219. Genesis 6:1-2.
220. See J. M. Bradshaw et al., *God’s Image 2*, Endnote M8-7, p. 244. See also J. M. Bradshaw, *God’s Image 1*, Excursus 24: The Watchers, pp. 585-590.
221. For a summary, see, e.g., A. T. Wright, *Evil Spirits*, pp. 61-75; J. J. Collins, *Sons of God*, pp. 261-263. See also J. M. Bradshaw et al., *God’s Image 2*, Endnote M8-35, p. 250.
222. R. D. Draper et al., *Commentary*, pp. 161-164.
223. Sebastian Brock in Ephrem the Syrian, *Paradise*, p. 189 n. 1:11.
224. Cf. Moses 7:17.
225. Ephrem the Syrian, *Paradise*, 1:11, pp. 81-82. See S. C. Malan, *Adam and Eve*, 3:4, p. 147; H. W. Nibley, *Enoch*, pp. 178-193; J. M. Bradshaw, *God’s Image 1*, *Commentary* Moses 5:41-b, p. 388.
226. J. C. Reeves, *Eutychiei*. See J. M. Bradshaw et al., *God’s Image 2*, Endnote M8-9, p. 244.
227. See *ibid.*, *Commentary* Moses 8:13-a, p. 225 and Moses 6:68-a, p. 84; J. M. Bradshaw, *Temple Themes in the Oath*, pp. 53-65. Cf. H. W. Nibley, *Enoch*, p. 180.
228. Moses 6:64-66.

229. Moses 6:67–68.
230. W. Bradley, *Why*, pp. 177-179.
231. J. A. Widtsoe, *Evidences*, p. 127.
232. J. M. Bradshaw et al., *God's Image 2*, p. 204.
233. Exodus 25:8-40.
234. 1 Chronicles 28:11-12, 19.
235. Genesis 6:14-16. Cf. E. A. Harper, *You Shall Make*, pp. 55-56; L. M. Morales, *Tabernacle Pre-Figured*, pp. 155-156.
236. C. H. T. Fletcher-Louis, *Glory*, p. 41. See also Wyatt's discussion of the arks of Noah and Moses, the Ark of the Covenant, and the story of Utnapishtim in *Gilgamesh* (N. Wyatt, *Water*, pp. 214-216).
237. L. M. Morales, *Tabernacle Pre-Figured*.
238. J. M. Bradshaw, *Moses Temple Themes*, pp. 77-87. Cf. Ephrem the Syrian, *Paradise*, p. 53; A. S.-M. Ri, *Caverne Syriaque*, p. 208. See the discussion in E. A. Harper, *You Shall Make*, p. 50 of readings of Genesis 6:16 in the Targums and the Septuagint, and for a description of parallels in 1 Kings 6:6 and Ezekiel 41:7.
239. J. D. G. Dunn et al., *Commentary*, p. 44. In other words, the dimensions of the Tabernacle courtyard have "the same width [as the Ark] but one-third the length and height" (Ronald Hendel in H. W. Attridge et al., *HarperCollins Study Bible*, p. 14 n. 6:14-16).
240. See Genesis 6:15 and Exodus 25:10.
241. M. Zlotowitz et al., *Bereishis*, p. 230; cf. U. Cassuto, *Noah to Abraham*, pp. 60-61; L. M. Morales, *Tabernacle Pre-Figured*, p. 155.
242. U. Cassuto, *Noah to Abraham*, p. 60. This recalls the ancient Sumerian story of Enki's Journey to Nibru, where the boat's movement is not directed by its captain, but rather it "departs of its own accord" (J. A. Black et al., *Enki's Journey*, 83-92, p. 332).
243. I.e., *ekallu* (11:96). See Mallowan, cited in N. Wyatt, *Water*, p. 215.
244. A. George, *Gilgamesh*, Standard Version 11:57-62, p. 90.
245. S. W. Holloway, *What Ship*, p. 346. Holloway's new proposal for the shape of Utnapishtim's ark met with opposition by Hendel (R. S. Hendel, *Shape*), to which Holloway published a rejoinder (S. W. Holloway, *ibid.*). As Wyatt

concludes, “Hendel’s objection was on a matter of a technicality, and he readily conceded the overall significance of the ark” (N. Wyatt, *Water*, p. 216).

246. Jean Bottéro, cited in R. S. Hendel, *Shape*, p. 129.

247. H. W. Nibley, *Before Adam*, p. 66.

248. E.g., F. S. Collins, *Language*, p. 126.

249. M. J. W. Leith, *Who Did Cain Marry?*, p. 22. In addition to what limited arguments can be made from biblical sources, Leith cites Egyptologist Gerald Moers, who “has observed that in ancient Egypt, the word for ‘Egyptian’ was also the word for ‘human.’ Foreigners/outsideers were inhuman or subhuman and represented injustice and chaos: Non-Egyptians were ‘barbaric ... [with] monstrous bodies ... animal-like, and a proper pharaoh kept them firmly under his foot.”

250. H. W. Nibley, *Before Adam*, p. 79.

251. With reference to a much earlier time (no later than approximately 30,000 BCE), there is a growing consensus among researchers that there was a limited amount of interbreeding between the ancestors of today’s humans and Neanderthals that led to modern humans carrying 1-4% of Neanderthal genes (Interbreeding?). The authors of one study believe they have “pinpointed the skeletal remains of the first known human-Neanderthal hybrid ... The finding came from northern Italy, where some 40,000 years ago scientists believe Neanderthals and humans lived near each other, but developed separate and distinctly different cultures” (500,000-Year-Old Neanderthal). Other researchers “suggest that interbreeding went on between the members of several ancient human-like groups living in Europe and Asia more than 30,000 years ago, including an as-yet unknown human ancestor from Asia” (E. Callaway, *Ancient Humans*).

252. R. Parr, *Missing*, pp. 94-97.

253. B. K. Harrison, *Truth*, p. 174.

254. See, e.g., J. F. Smith, Jr., *Doctrines*, 3:74-75.

255. George Reynolds and Janne M. Sjodahl conclude that the “division” “evidently refers to the allotment of the habitable portions of the earth to various families, tongues, and nations after the flood, under patriarchal inspiration” (G. Reynolds et al., *Commentary on the Book of Mormon*, 2:319).

256. S. H. Faulring et al., *Original Manuscripts*, pp. 119, 633.

257. Cf. Hebrew *gibbor*. See J. M. Bradshaw et al., *God’s Image 2*, p. 41.

258. See *ibid.*, COMMENTARY Genesis 10:8-c, p. 361.

259. Aramaic would presume a setting for the story no earlier than the beginning of the first millennium BCE.
260. Whether one thinks about this in terms of the LDS tradition of an “Adamic language” or in some other way.
261. Genesis 10:5, 20, 31.
262. Genesis 11:1, 6. It may be significant that the JST for these verses reads: “the same language,” not “one language.”
263. V. P. Hamilton, *Genesis 1-17*, p. 350. Drawing a modern comparison, Nibley quipped that it was “like some of these space thrillers on the TV where everybody knows English. No matter where you go in the universe, they all speak the same language” (H. W. Nibley, *Teachings of the Book of Mormon*, 4:266).
264. See quote by Nibley above on *eretz*.
265. A. LaCocque, *Captivity of Innocence*, p. 66, citing Paul Ricoeur.
266. V. P. Hamilton, *Genesis 1-17*, p. 358.
267. Drawing a rough analogue between the development of genetic and linguistic differences, Cavalli-Sforza writes (cited in R. T. Pennock, *Tower*, p. 143):
- During modern humanity’s expansion, breakaway groups settled in new locations and occupied new continents [cf. the Jaredites]; from these, other groups broke away and traveled to more distant regions. These schisms and shifts took humanity to very remote areas where contact with the original areas and peoples became difficult or impossible. The isolation of numerous groups had two inevitable consequences: the formation of genetic differences and the formation of linguistic differences. Both take their own path and have their own rules, but the sequence of divisions that caused diversification is common to both. Their history, whether reconstructed using language or genes, is that of their migrations and fissions and is therefore inevitably the same.
268. V. P. Hamilton, *Genesis 1-17*, p. 358.
269. B. A. Gardner, *Second Witness*, 6:165.
270. See Genesis 11:4. For more on temple themes in the story of the Tower of Babel, see J. M. Bradshaw and D. J. Larsen, *God’s Image 2*, pp. 390-396.



# THE SCALE OF CREATION IN SPACE AND TIME

John S. Lewis

The accounts of creation in Genesis, Moses, and Abraham as well as in higher endowments of knowledge given to the faithful are based on visions in which the seer lacked the vocabulary to describe and the knowledge to interpret what he saw and hence was obliged to record his experiences in the imprecise language available to him. Modern attempts to explain accounts of these visions frequently make use of concepts and terminology that are completely at odds with the understanding of ancient peoples: they project anachronistic concepts that the original seer would not have recognized. This chapter reviews several aspects of the creation stories in scripture for the purpose of distinguishing anachronistic modern reinterpretations from the content of the original vision.

## The Extent of Creation

Genesis is often read as a description of the origin of the Universe rather than the Earth. But ancient views of the cosmos had no concept of anything remotely similar to our modern sense of the word “Universe.” In the ancient world the general concept was that Earth was the center of creation. The heavens were the night sky as seen by the naked eye from Earth’s surface, tacitly assuming it to be a local and Earth-fixed phenomenon. The cosmos so imagined by most philosophers may have been mere thousands of kilometers in diameter, although Archimedes suggested a size of about two light years.

The cosmos (Greek: *ὁ κόσμος*; “order”) was an intimate spherical volume centered on Earth and containing the Sun, Moon, and known planets (Mercury, Venus, Mars, Jupiter, and Saturn). These seven bodies were generally pictured as much smaller than Earth and very close. They were all assumed to travel around Earth, which was fixed and immobile at the center of the Kosmos. This set of seven *wandering* heavenly bodies, collectively called “planets” (Greek: *οἱ πλάνητες ἀστέρες*; “wandering stars”) was regarded as complete and final, since seven was a mystical



Figure 1: *Birth of a Solar System*

number symbolic of perfection. Similarly,  $3\frac{1}{2}$  was regarded as a broken number symbolic of disaster, as in Revelation. In Latin, each such planet was referred to as *stella errans*, “wandering star,” or “unruly star,” with no concept that Earth and the planets were bodies of similar nature. The earth (lower case) was literally the ground on which we stood, in classical thought the sole fixed base in all creation. Earth (capitalized) is a modern concept that recognizes our planet as yet another member of a family of related bodies, a fellow-wanderer in the Sun’s family, not the center of all creation. It embodies the Copernican notion of Earth as an eighth wanderer.

The seven planets of antiquity wandered in complex and largely unpredictable (unruly; rule-less) patterns across the sky. There was no room for planetary satellites (moons), asteroids, etc. Meteors, comets, or meteorites in this conception must not be real material bodies, but signs sent by God. Further, the seven heavenly bodies must be perfect, featureless celestial spheres, not composed of gross matter. It was implicit that the creation of this tiny Earth-centered cosmos was a single creative event or episode. Our present understanding of the vastness of the Universe is a product of twentieth century astronomical research, completely alien to the ancient mind. Indeed, the Universe as now understood is vastly larger than any astronomer of the year 1900 could have imagined. Since all ancient creation concepts were Earth-centered and local, they were stories of the creation of Earth. Everything else was either incidental or non-physical. Earth was not so much the center of creation as the only material body in creation.

These conceptions persisted for millennia. There is a wonderful (but sadly undocumented) tradition that Thomas Jefferson, no mean natural philosopher himself, upon reading of the 1807 fall of the Weston, Connecticut, meteorite in Silliman’s *American Journal of Science*, responded, “I would find it easier to believe that two Yankee professors would lie, than that stones should fall from the sky.”<sup>1</sup> As late as the mid-1800s meteorites were often assumed to be volcanic debris.



Figure 2: *Fantastic Depiction of the Solar System*, German School, 19th century, colorized

The cosmos thus pictured did not even include the stars. Until the seventeenth century it was nearly universally accepted that the surface of the cosmic bubble, the black “dome of heaven,” was close to Earth and enclosed all creation. This “firmament” was a solid (firm) dome surrounding our little cosmos. The stars were often described as pinholes in the firmament that admitted light from the celestial realms above into our tiny universe. The Latin word *firmamentum* conveyed no sense of vast spaces and countless other Suns and worlds. It meant a support, framework, or prop—a strong, solid structural element. The dome of the sky was just that, a dome. To the ancients, therefore, the heavens were just the local envelope that surrounded Earth and its seven celestial companions. The scriptural account of creation was a narration of the creation of Earth and, implicitly, its seven accompanying wanderers. Calling it an account of the creation of the Universe is a historical absurdity.

If we were to define “Universe” as meaning *everything that exists*, the Hebrews and Greeks would have pictured it as referring at least to Earth, and possibly to the realm of the seven wanderers (the part of the Solar System known to them), so that their understanding of the word “Universe” would have reflected a wildly different concept of the scale of material existence than that familiar to us. The heavens, what can be seen by the unaided eye from Earth’s surface, would correspond rather closely to their understanding of what “Universe” must mean. This was the general view of antiquity. This was the model adopted by Aristotle and passed by him down through the Middle Ages: a cozy, Earth-centered creation in which Earth itself was the only true material object. Aristotle, arguing that Earth was the center, and



that “all things tend toward the center,” concluded that other gravitating bodies were impossible because “there cannot be more than one center.”<sup>2</sup> There were no other stars, no other Earths. Scripture, interpreted in this manner, seemed to make Creation synonymous with the creation of Earth.

This conception had not been shared by all the Greeks. Some imagined the stars to be other Suns, each with a cosmos of its own, packed together like a barrel full of bubbles. But Aristotle argued that such bubbles had to be spherical (since, according to Plato, the sphere was a perfect shape, and everything in the heavens was by definition celestial and therefore perfect). Spheres, however, cannot be packed together so as to fill space.

Therefore if there were other *κοσμοι*, there would have to be voids in the interstices between the bubbles. But this was impossible under Aristotle’s principle that “nature abhors a void,” and thus it was impossible for the stars to be other suns with their own families of planets. Note that all these governing principles (perfection of spheres, mystical numbers, abhorrence of voids) were nothing more than the wisdom of men, not based upon observations of the Universe and not even in principle testable or verifiable. The authority of a Plato or Aristotle took precedence over observation. Aristotle’s writings, adopted and taught by the Church, shaped interpretations of scripture for centuries to come: our understanding of sacred texts was made to conform to pagan philosophy.

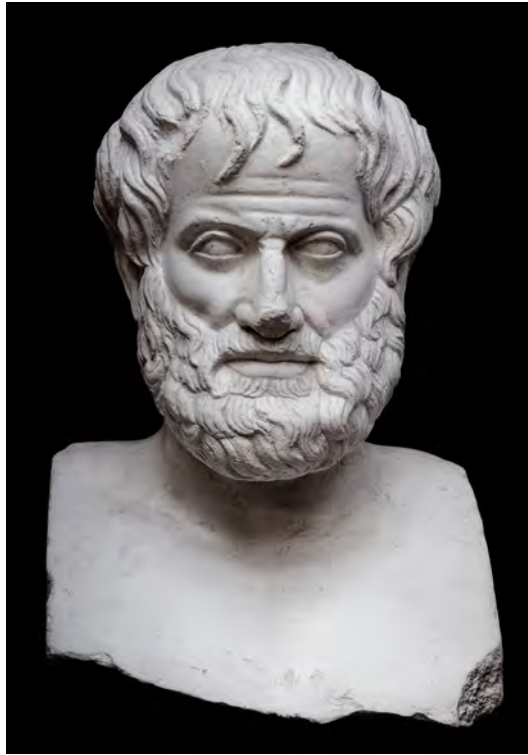


Figure 3: *Bust of Aristotle, 384-322 BC*

### The Age of Earth

Eighteenth and nineteenth century authorities typically take the word “day” in Genesis to be literally one modern Earth day, even though such days did not exist until day four of the creation, and the Hebrew word יֹמ (yōm) was used both literally and figuratively, as in English. It is well known that such a constrained time scale is ruled out by every available method of dating astronomical and geological history.

The antiquity of Earth was a subject of active debate in the early nineteenth century. Some adherents of a conservative interpretation of scripture ignored or sought to explain away the overwhelming evidence from geology. The more liberal scientific interpretations of geological history suggested an age of 100,000 to millions of years for Earth. Almost alone, W. W. Phelps, Joseph Smith’s book of Abraham



Figure 4: Photo Montage of Isis Temple at Philae Island and a Star-Birthing Region in the Orion Nebula

scribe, offered a vastly larger perspective. In the *Times and Seasons*, a letter from Phelps to the Prophet's brother William states:

That eternity, agreeable to the records found in the catacombs of Egypt, has been going on in this system (not the world)<sup>3</sup> almost 2555 millions of years; and to know that deists, geologists and others are trying to prove that matter must have existed hundreds of thousands of years: — it almost tempts the flesh to fly to God, or muster faith like Enoch to be translated and see and know as we are seen and known!<sup>4</sup>

Lacking any explanation of what was meant by “this system” and “the world,” it is difficult to compare these numbers to much more precise ages of specific events determined by science. The nineteenth-century usage of “world” encompassed everything from planet to Creation, whereas the word “system” in an astronomical context suggests the Solar System.

The relationship between human time and God's time is hinted at in several places in scripture. The Bible offers only a single explanation when Peter writes:

But, beloved, be not ignorant of one thing, that *one day is with the Lord as a thousand years, and a thousand years as one day.* (2 Peter 3:8, emphasis added)

This certainly cautions us regarding the figurative nature of this measure of time, and suggests that God's time is enormously flexible compared to our Earthly time. But both of the statements in 2 Peter 3:8 cannot simultaneously be literally true.

Elder Bruce R. McConkie has also commented that the days of creation are figurative, and not to be taken literally. In the June 1982 *Ensign* he wrote, “What is a day? It is a specified time period; it is an age, an eon, a division of eternity.”<sup>5</sup> We commend this statement to those Church members who believe that Elder McConkie advocated a one-week duration for the creation.

Considering that Doctrine and Covenants 77:6 refers to “...this earth during the seven thousand years of its continuance, or its temporal existence,” what led Phelps to speak of Earth as 2,555 million years old? The answer appears to be straightforward. Though 7000 Earth years is in conflict with all physical, chemical, genetic, archaeological, and linguistic evidence, 7000 years of God is not ruled out. The arithmetic is easy. One day of God is 1000 years of man, and therefore in Joseph Smith’s reckoning, a day of God is  $365 \times 1000$  days of man. The 2.555 billion years in question therefore corresponds to  $2,555,000,000/365,000$  years of God, which is 7000 years of God for each day of Earth’s existence. A more careful calculation, using the true average length of the year including leap years (365.257 days) gives 2,556,799,000 Earth years. Clearly Joseph Smith did not intend the “7000 years” of Earth’s age to refer to Earth years.

The same number surfaces again in Elder McConkie’s address, “The Seven Deadly Heresies,” delivered at BYU in 1980. He refers to God as “an infinite and eternal being who has presided in our universe for almost 2,555,000,000 years,”<sup>6</sup> but without any indication of the source or significance of that number.

In the book of Abraham (5:13), after a discussion of the creation of Earth in which the stages are called “times” instead of days, we find “Now I, Abraham, saw that it was after the Lord’s time ... for as yet the Gods had not appointed unto Adam his reckoning.” This may have been the scriptural basis for Phelps’s calculation.

### **Creation as an Ongoing Process**

The creation of Earth is explicitly described in LDS scripture as a process of bringing order to chaotic matter, not as the creation of matter *ex nihilo*. This is in perfect accord with the scientific evidence regarding the creation of Earth. It also places the origin of matter in the distant past, not as a part of the events surrounding Earth’s formation, a conclusion also in accord with scientific studies of the origin of the elements starting 13.7 billion years ago.

LDS scripture, beginning with the book of Moses, portrays creation as diachronic: spread out over time. Many worlds came into existence before Earth existed, and many no longer exist; creation continues to the present (see Moses 1:33-38). In LDS doctrine, there are governing laws “irrevocably decreed in heaven before the foundation of the world” (D&C 130:20), on the basis of which laws worlds come into being, age, and die. Life on earlier worlds is a natural consequence of this view.

President Snow's couplet saying that God once lived in mortality on a world similar to ours requires that generations of planets pre-existed Earth. The laws of nature, on which the formation, evolution, and death of worlds over lifetimes of billions of years are predicated, must have been in existence long before the formation of our planet.

Thus the origins of the Universe and of Earth were widely separated events. The origin of Earth and the rest of the Solar System 4.55 billion years ago occurred in the context of a collapsing interstellar cloud, just as we see today in the Orion Nebula and elsewhere, accompanied by the simultaneous formation of thousands to millions of other stars and planetary systems in a starburst. The role of stars in the Earth Creation story is variously represented by the different scriptural sources. Genesis says that on the fourth day "he made the stars also. And God set them in the firmament of the heaven to give light upon the earth" (Genesis 1:16-17). The book of Moses says "the stars also were made even according to my word. And I, God, set them in the firmament of the heaven to give light upon the earth" (Moses 2:16). The book of Abraham likewise has the Sun, Moon, and stars "organized" in the "expanse of heaven" on the fourth "day" (Abraham 4:14-15). We are also told in another place that "he caused the stars also to appear." Is it just that the stars became visible from the vantage point of Earth's surface on the fourth day, or were they created after Earth was already old enough to have life? Interestingly, the astronomical evidence favors most stars being far older than Earth, but the starburst associated with the origin of the Solar System would also have formed thousands to millions of nearby stars in the same creative episode, some forming a little earlier than the Sun, and some a little later.

LDS scriptures conform well to our reading of Genesis as the story of the creation of Earth. The extension of this scripture to the Universe and its origin is inconsistent with science and is an anachronistic misreading of the story, inserting the concept and word Universe where scriptures do not. Creation was going on for billions of years before the creation of Earth and continues today. Earth is indeed billions of years old, as Joseph Smith was one of the very first to say.

The visions recounted in scripture, viewed as attempts to convey the seer's experiences without access to modern terminology, are remarkably informative and deserving of study. We would do well to try to picture what the seer saw, and to be cautious in our interpretation of those visions in terms of concepts alien to the seer's conceptual framework.

### Conclusion

As scientists, we can understand a great deal about when things happened, where they happened, how long they took, but science is completely silent on the subject of the who and the why of creation. There is no way that you can answer those questions from observation. The universe was created by God and we know from the New Testament that, in this case, it was actually Jesus Christ who carried out





Figure 5: *Photo Montage of the Hubble Space Telescope Observing Deep Space While Orbiting the Earth*

the work in accordance with the plan, which I suppose would permit us to call our Heavenly Father the architect of existence and Jesus Christ the builder.

If the scriptures are God's handiwork and the universe is God's handiwork, then science and religion represent two independent witnesses of creation. And we're told throughout the Old Testament that two or more independent witnesses are required in order to certify the truth. They are not opposites but they are like the views seen from your two eyes. If you close one eye and then close the other, alternating back and forth, you don't see the same thing with the two eyes. But, it is the combination of those two views, which gives you three-dimensional perception and shows you a lot of things that neither eye by itself sees.

I am awed when I look at the Hubble Deep Space Telescope images where every spot of light in the picture is a galaxy. And every one of those galaxies has hundreds of billions of stars in it, and those galaxies are in all different shapes and colors. I think about how many worlds are within that field of view. I find it deeply touching, say nothing of what it does to the scientific side of my brain. It's so valuable to gain a new perspective on who you are and where you are and what's around you. The famous British astronomer Sir Arthur Eddington said the more we learn about the universe the less it looks like a great machine and the more it looks like a great thought.

### Endnotes

1. “Ursula Marvin of the Harvard-Smithsonian Center for Astrophysics reports that the closest remark recorded from Jefferson on the subject is as follows: ‘We certainly are not to deny what we cannot account for. ... It may be very difficult to explain how the stone you possess came into the position in which it was found. But is it easier to explain how it got into the clouds from whence it is supposed to have fallen? The actual fact, however, is the thing to be established’” (Linda T. Elkins-Tanton, *Asteroids, Meteorites, and Comets* (New York City, NY: Infobase Publishing, 2010), 24).
2. Aristotle, *On the Heavens*, Book 1, Part 8.
3. “The phrase ‘(not the world)’ was added to the 1844 article as originally published. It is not known who added the phrase — Phelps, the editor, or someone else” (E. R. Paul, *Science, Religion, and Mormon Cosmology* (Urbana, IL: University of Illinois Press, 1992), 190 n. 47).
4. W. W. Phelps, “The Answer,” *Times and Seasons* 5 (December 1844): 758.
5. Bruce R. McConkie, “Christ and the Creation,” *Ensign* 12:6 (June 1982), 11.
6. Bruce R. McConkie, “The Seven Deadly Heresies,” in *1980 Devotional Speeches of the Year* (Provo, UT: Brigham Young University Press, 1980), 75.



# JOSEPH SMITH AND MODERN COSMOLOGY

Ron Hellings

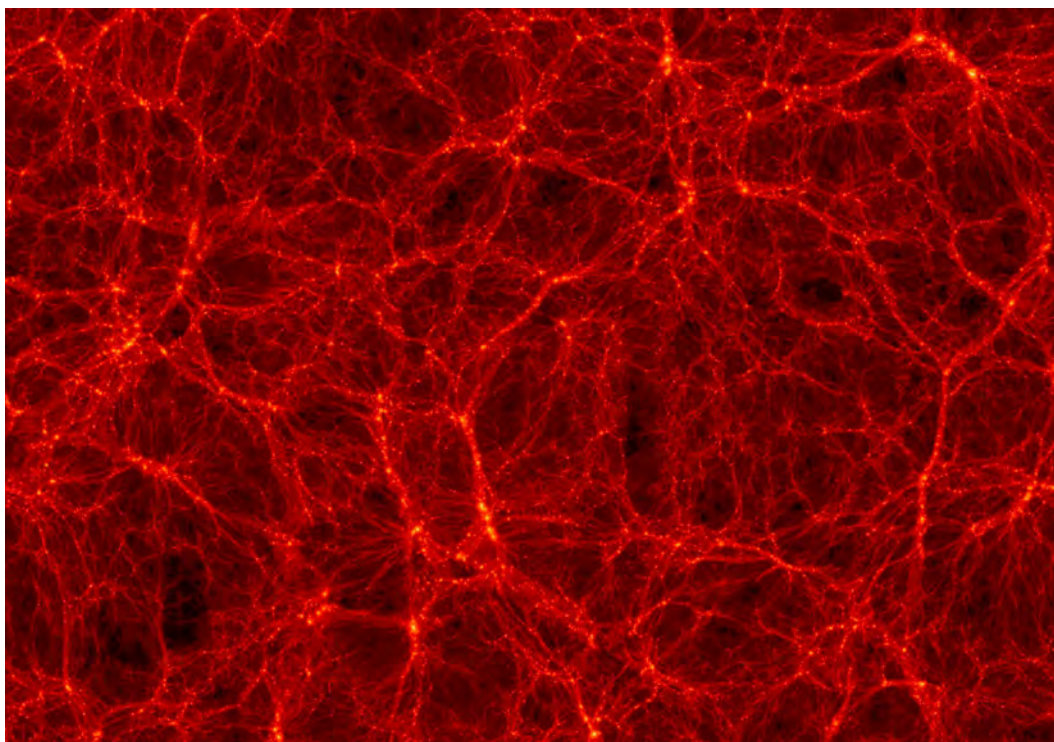
The goal of this chapter is to take a look at some of the teachings of Joseph Smith that seem to have cosmic implications and to try to understand these in light of modern cosmology.

## Modern Cosmology

Let me begin by stating that this is an extremely exciting time to be doing cosmology. In the last thirty years, we have learned so much about the universe that we are now completely mystified and profoundly confused. We understand less than five percent of the content of the universe — atoms and molecules and fields and radiation and all of the other things we know. The rest, ninety-five percent of the content of the universe, is completely unknown. Twenty percent of the universe appears to be what is called *dark matter*. We know several things that dark matter is not, and we still have a few ideas about what it might be, but we do not know what it is. But dark matter, at least, acts in a way we understand. The remaining seventy-five percent of the universe must be something for which we don't even have very good ideas. It is something called *dark energy*. Whatever dark energy turns out to be, it's going to require a revolution in our understanding of physics.

The simplest way to explain the dark energy result would be to reinstate Einstein's cosmological constant and give it just the right value to have the effect we need. This is somewhat like having a theory that says  $2 + 2 = 5$  and saying that it's a great theory as long as you agree to subtract 1 from the answer. Another possibility is that the dark energy is actually a quantum mechanical vacuum energy density. The only problem here is that when we calculate what that energy density should be, we get an answer that is  $10^{120}$  times too big. Even in astronomy, it's tough to get an answer that's *that* wrong. So, many people feel there is just some new dynamic fluid out there that we don't otherwise know about. They have given it a name; they call it "quintessence." It makes up seventy-five percent of the universe, and there





**Figure 1.** *Result from the Bolshoi Simulation of Structure Formation in a Universe with Dark Matter and Dark Energy*

are lots of heuristic models used to describe it. But it has to be a very strange stuff. It has to have a negative pressure as its equation of state, and no normal energy or matter can do that. So finally some have suggested that Einstein's theory of general relativity, his gravitational theory, is fundamentally wrong and will have to be replaced. Whatever happens, there is going to be a radical change. Ideas that would have labeled someone a crackpot ten years ago are now being published in the finest journals. And everyone, as I said, is quite confused.

One of the things that I did when I was at the National Aeronautics and Space Administration Headquarters was to serve as the NASA representative to a group that NASA, the National Science Foundation, and the Department of Energy had put together called the Dark Energy Task Force. Their goal was to discuss the dark energy problem and to advise the agencies about the best ways to go forward to work it out. When I went to their meeting the first time, I saw a lot of people I knew and a lot of people I didn't. At the first coffee break, I got something to eat and came back and sat down at the table. Then I noticed this little knot of people sitting at one end of the table and talking. One of them was holding forth on Mormonism. It turns out that, just the weekend before, *Time Magazine* had come out with one of their regular articles explaining Mormonism to the world, and this guy was explaining about the Church and about how silly some of the Mormon doctrines were. I had just gotten to the point where I was thinking I should get up and go over there and say something when they called the meeting to order again. One of the guys who had been in the group, a guy I knew, came over and sat down next to me, and he leaned over and said, "You're a Mormon, aren't you?" And I said, "Yes I am. And I've

got to tell you I think it's ironic for a member of the Dark Energy Task Force to be ridiculing anyone else's beliefs."

They say you should start a talk by stating your main points, and so here's one of my main points: This is no time for anyone to be criticizing anyone's beliefs based on what cosmologists know.

### **Lord Kelvin on Physics**

There is another point I would like you to take away. I hope you'll remember these next two thoughts. In the years leading up to the start of the 20th century, British Physicist Lord Kelvin is reported to have said:

There is nothing new to be discovered in physics now. All that remains is more and more precise measurement.<sup>1</sup>

First, let's be clear about one thing: Is he right? No. This is absolutely not a correct statement. So how could he have said this? Maybe you might think he wasn't very smart or didn't know much physics. Who was Lord Kelvin? We name our absolute temperature scale after him. He did marvelous things in electricity and thermodynamics; he was aware of the entire field of physics at the time; he was one of the brightest physicists around. So here's a question you need to ask: How could he be so wrong? How could someone who knew that much come to this conclusion, which was so obviously wrong?

### **Joseph Fielding Smith on Space Travel**

While you're pondering that, let me give you another quote. This is Joseph Fielding Smith in 1957:

It is doubtful that man will ever be permitted to make any instrument or ship to travel through space and visit the moon or any distant planet.<sup>2</sup>

I should point out first that this is not a scientific conclusion but a religious one. This is a conclusion he came to by reading the scriptures, interpreting them, and deciding that earth was for man and the moon was not. He concluded that we would therefore have no business being there. But let's be clear: was he right or wrong? Clearly, he was wrong. Do you know who Joseph Fielding Smith was? Was he someone ignorant of the scriptures or not very smart? Neither of those, right? This was a man who knew the Gospel as well as anyone in the Church at that time. He was a giant in scriptural understanding and interpretation. And so the other question you need to be asking yourself is this: How could he be so wrong?

As you're pondering that one, let me give you a quick quiz question here.

If you ever see what appears to be a conflict between science and religion, can you think of at least two places where the problem might lie?

All right, I hope you can answer that question appropriately.

### Joseph Smith's Cosmology

Now I want to talk about cosmology and see if there is a conflict between science and our LDS religion in this area. I want to begin by summarizing a few things about Joseph Smith's cosmology. I have two basic guidelines I want to follow as I do this. The first is that I'd like to say something worthwhile, and the second is that I would like to keep the nonsense to a minimum.

Let me explain what I mean by the first goal. It would be the easiest thing in the world for me to stand up here and weasel and waffle and wave my hands and say, "You know, Joseph Smith was speaking in language we don't understand, and we don't know if he was claiming prophetic inspiration for what he said, so we really can't say anything about his views of cosmology." But I don't believe that.

Joseph Smith was an extremely inquisitive man. In March of 1839, he made this most amazing statement:<sup>3</sup>

Thy mind, O man, if thou wilt lead a soul to salvation, must stretch as high as the utmost heavens and search into and contemplate the darkest abyss, and the broad expanse of eternity — thou must commune with God.

Let me suggest to you that Joseph Smith did commune with God and that, as a result, he did acquire cosmological insights and tried to teach them in his sermons and writings. In this talk I want to take his teachings as much at face value as I can and try to make as much scientific sense of them as I can.

Now, it might be interesting to compare what Joseph said with what contemporary scientists and philosophers were saying. But I don't think that this would really be very useful. Joseph was not a man of science, and I am not convinced that we have any idea what he knew about what others were saying. So it is difficult to make any case for interpreting his statements in light of their language. I do not really want to go in that direction.

But I do need to remember that Joseph would not speak in modern scientific terms. One powerful statement that he made is found in Doctrine and Covenants 131:7:

There is no such thing as immaterial matter. All spirit is matter, but it is more fine or pure.

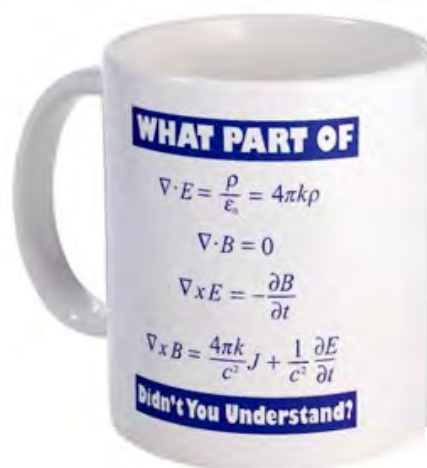
Now, unfortunately, he did not say, "All spirit is matter, but it coupleth to a different metric." I wish he had said that because then I would understand what he meant. But he would have no business talking like that in 1840, so we have to speculate a little to see what he might have meant by the language he used.

As I said, the second guideline I want to observe in this presentation is that I want to keep the nonsense to a minimum. Let me tell you what I mean by this. Let me read you one of Joseph Smith's revelations from Doctrine and Covenants section 88:7-11:

This is the light of Christ. As also he is in the sun and the light of the sun and the power thereof by which it was made. As also he is in the moon and he is in the light of the moon and the power thereof by which it was made. As also the light of the stars and the power thereof by which they were made. And the earth also, and the power thereof, even the earth upon which you stand. And the light which shineth, which giveth you light, is through him who enlightened your eyes, which is the same light that quickeneth your understandings, which light proceedeth forth from the presence of God to fill the immensity of space.

I look at that and say, “All right. Light. I’m a physicist. I know everything there is to know about light. This is light. Electromagnetic radiation, Maxwell’s equations.

But when I try to apply what I know about light to Section 88, I realize that I have no idea what Joseph Smith was talking about. He was certainly not talking about normal light. He was not talking science. So “keeping the nonsense to a minimum” means that I am not going to pick up every statement Joseph Smith ever made that seems to have some cosmic content to it and force it into some global theory that I will then attribute to Joseph Smith. I will only consider elements of Joseph’s teachings that are relatively unambiguous and that remain consistent over the years.



**Figure 2.** Maxwell’s Equations Mug. Light is a form of electromagnetic radiation.

So, now, on to the task. Let’s talk about three aspects of Joseph Smith’s cosmology.

### 1. Matter Is Conserved

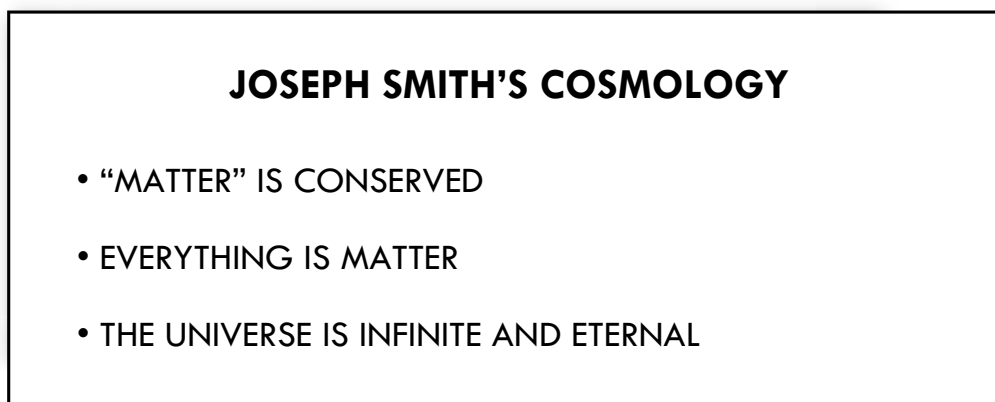
I’d like to read you two statements from Joseph Smith. The first is in 1839. This was something he said to the apostles and seventies as they were going off on a mission:

Anything created cannot be eternal; and earth, water, *etc.*, had their existence in an elementary state from eternity.<sup>4</sup>

The second is from the King Follett Discourse:

The pure principles of element are principles which can never be destroyed; they may be organized and reorganized, but not destroyed. They had no beginning and can have no end.”<sup>5</sup>

“Elementary state” and “pure principles of element.” What did he mean by those words? He was trying to express something in the language he had, but it is difficult to make modern sense of it. Was he saying that each atom must retain its eternal character? Modern science has certainly disproved that. Or was he saying that there is something that underlies all elements that is a conserved quantity? That idea holds more promise. We will summarize this general idea, whatever it means



**Figure 3.** *Elements of Joseph Smith's Cosmology.*

precisely, with the phrase “Matter is conserved.” We have left “matter” in quotes and may want to revisit possible meanings for “pure principles of element” later.

## **2. Everything Is Matter**

Here are a couple of additional statements of Joseph Smith: We already read “There is no such thing as immaterial matter” (D&C 131:7). That’s in the Doctrine and Covenants. We also saw that “All spirit is matter, but it is more fine or pure” (D&C 131:7). And, finally, we read in the Doctrine and Covenants that “The Father has a body of flesh and bones as tangible as man’s” (D&C 130:22). The point here is that whether we talk about the material world, the divine world, or the spirit world, we are talking about real things. One of the characteristics of matter is that it has mass, so everything should be detectable by its gravity. There is nothing intangible or imaginary about the universe. Whatever Joseph meant by “matter,” it is clear he meant that nothing else exists. Let us summarize this idea with the statement “Everything is matter.”

## **3. The Universe Is Infinite and Eternal**

In one of his last discourses, Joseph Smith taught, “Intelligences exist one above another, so that there is no end to them.”<sup>6</sup> If there is no end to the present number of ranked intelligences, then there must presently be an infinite number of them. “Intelligence of spirits had no beginning, neither will it have an end.”<sup>7</sup> So there is an eternal existence to those intelligences. And just to remind you: “There is no such thing as immaterial matter” (D&C 131:7). Finally, all of this infinite and eternally existing material stuff has to exist somewhere. “And there are many kingdoms; for there is no space in the which there is no kingdom; and there is no kingdom in which there is no space.” (Doctrine and Covenants 88:37). With these statements, Joseph Smith committed LDS doctrine to a universe that is infinite in size because it has to hold an infinite number of real things and eternal in scope because those real things are uncreated and indestructible. The universe is infinite and eternal.

### **Cosmology 1840-1930**

Now let's compare these elements of Joseph Smith's cosmology to the elements of scientific cosmology in the years from 1840 to 1930.

#### **1. Matter Is Conserved**

In 1840, Lavoisier's experiments had proven that mass was conserved in chemical reactions. But at that time there was not yet much interest in the concept of energy. It wasn't until later that heat was understood to be a form of energy and that energy too was conserved, just like mass. Just after the turn of the century, it was found that mass was actually a form of energy and that mass could be converted into energy and vice-versa. So you could no longer say that matter was conserved but only that total energy was conserved, total energy that included the energy associated with mass. Then finally in about 1920, scientists realized that matter and energy were really just different names for the same thing, so it could again be stated that matter, which now meant the same as energy, was conserved.

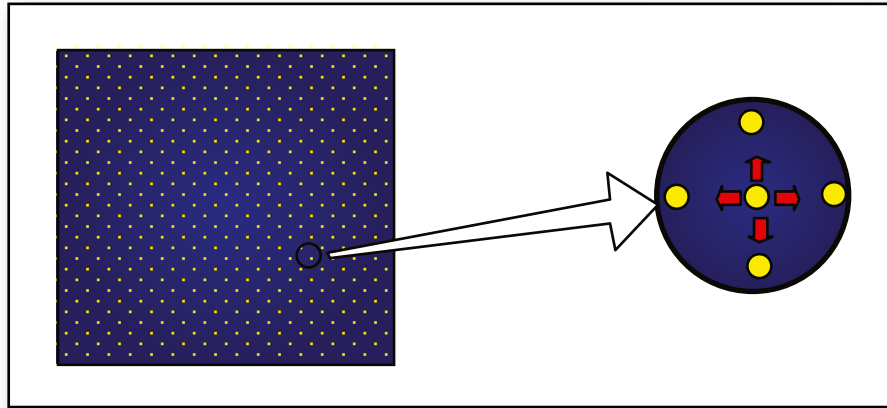
#### **2. Everything Is Matter**

Science had long concerned itself only with the material world, so it is not very profound to point out that it was science's view that there was nothing in the universe but matter and the forces that affected the matter. However, during the period we are considering, the way of looking at the forces between objects changed to say that forces arise through the exchange of particles of energy and matter. So it did indeed become important to say that everything is matter — atoms, charges, and even the fields that create the forces on them.

#### **3. The Universe Is Infinite and Eternal**

The last main idea underpinning the scientific view of cosmology at the time of Joseph Smith is one not as well appreciated today. It grew out of Newton's theory of gravity, combined with actual astronomical observations. First, Newton had proved that all massive objects attract each other with a gravitational force, so any two things will pull on each other, no matter where they are in the universe. Second, observations showed that the universe is static. This creates an interesting problem. Figure 4 shows a block of the universe, uniformly filled with stars (the yellow dots in the figure). If we take a little piece and examine it closely, we see one star that is sitting in the gravitational field of all the other stars in the universe.

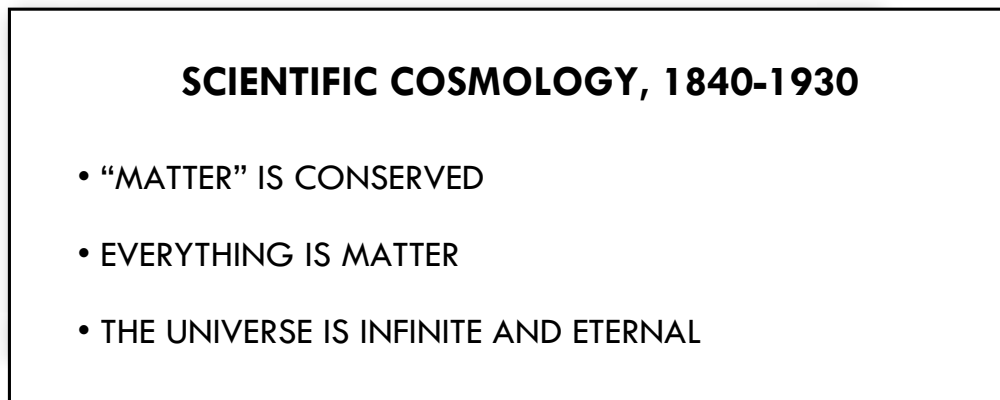
The red arrows in the blow-up represent the gravitational forces on the star due to the neighboring stars. If the universe is to be static, as observations seemed to say it was, then all those forces have to balance exactly. The only way you can do that is if the universe is infinite in all directions and perfectly homogenous. The Newtonian universe has to be infinite. And since the observed universe is static, it must also be eternal. No one discovered until the late 1800s that this universe is unstable, and



**Figure 4.** *A small section of an infinite universe filled with stars (at left). If we blow up a section, we see the gravity balance required for a static universe.*

in fact, if you move anything a little bit, the whole thing collapses. But the laws of nature did seem to require a universe that was infinite and eternal.

So you see where this leaves us. From 1840 to 1930, the scientific cosmological view of the universe evolved to look like what is summarized in Figure 5. You may have seen something like this before. (Hint: Go back and look at Figure 3.)



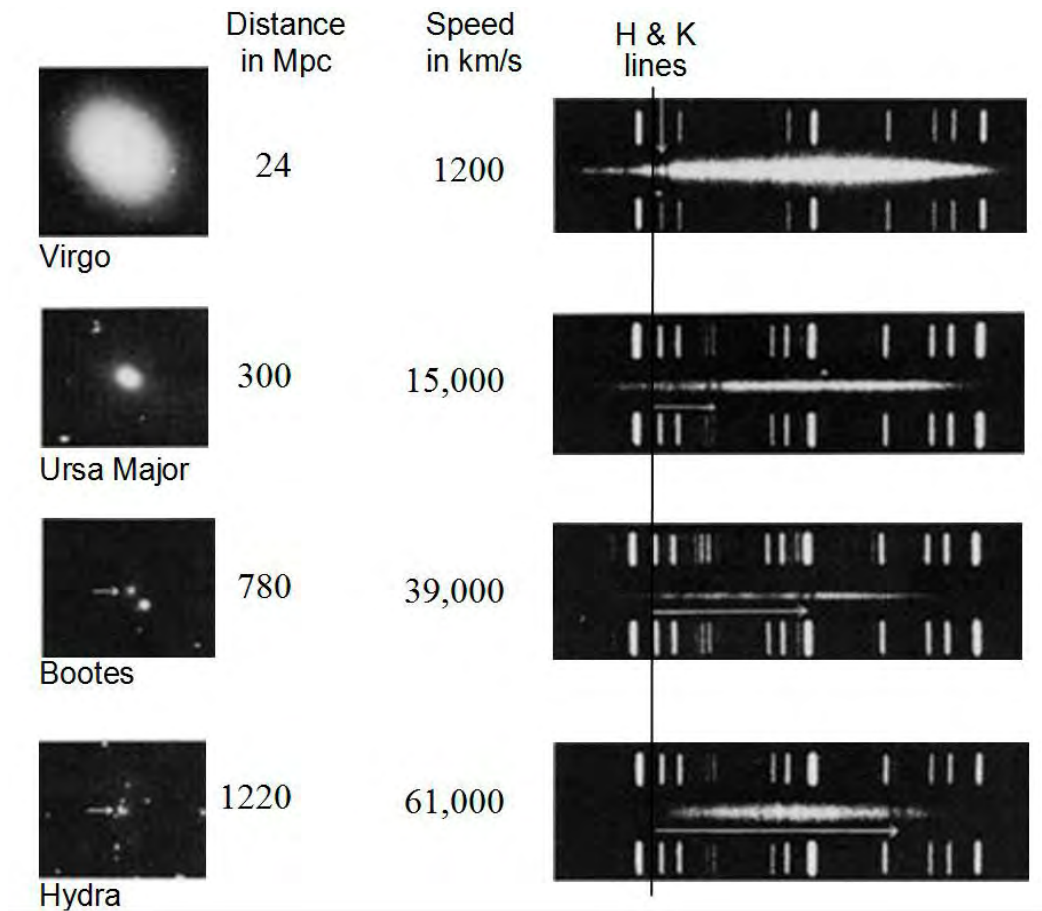
**Figure 5.** *Elements of Scientific Cosmology, 1840-1930*

For 90 years, the LDS Church looked pretty good in contrast to the poor Catholics and Protestants who were stuck with the medieval doctrine of creation *ex nihilo*. The Mormons, for a change, had scientific opinion on their side.

### The Expanding Universe

But something happened in 1930 to change all that. The change occurred as Edwin Hubble combined his own measurements of distances to various galaxies with previous measurements of their speeds to produce the comparison shown in Figure 6.





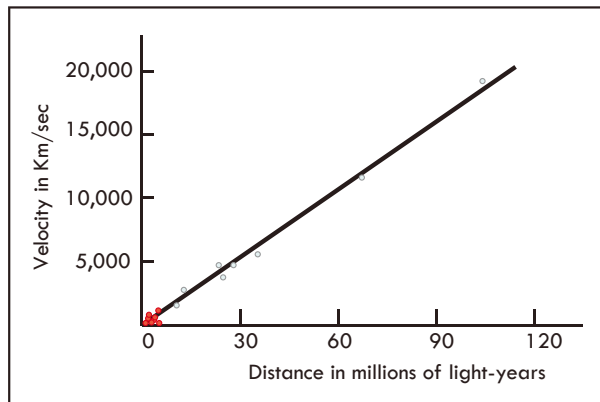
**Figure 6.** *The Hubble Relation.* Galactic redshifts demonstrating that the velocity of a galaxy is proportional to its distance.

The photograph in the upper-left of Figure 6 is a picture of a galaxy in the constellation Virgo. To its right we see what the light from that galaxy looks like when it is spread out in a spectrum. Violet is on the left of the spectrum and blue is on the right (this is just one piece of the spectrum). At the point labeled with the little down-arrow, we see two absorption lines. These are the H and K lines of ionized calcium, and they are almost where they would be if the calcium ions were in the laboratory, but they are a little shifted to the right. By looking at the brightness of the galaxy we can tell the distance to it (it turns out that it's twenty-four megaparsecs away). By looking at this Doppler shift in wavelength toward the red end of the spectrum (longer wavelengths), we can determine the velocity of that galaxy relative to us. It's moving away from us, and the velocity is 1,200 kilometers per second. Now we do that with a galaxy further away in *Ursa Major*. You'll notice those same two lines are there, and they're now moved further toward longer wavelength. The distance is greater, and the red shift is greater. We can do the same thing with a galaxy further away, in *Bootes*. And finally there's a little galaxy you can barely see, there in *Hydra*. Those two absorption lines are almost off the spectrum to the right, giving a speed measurement of 61,000 kilometers/second.

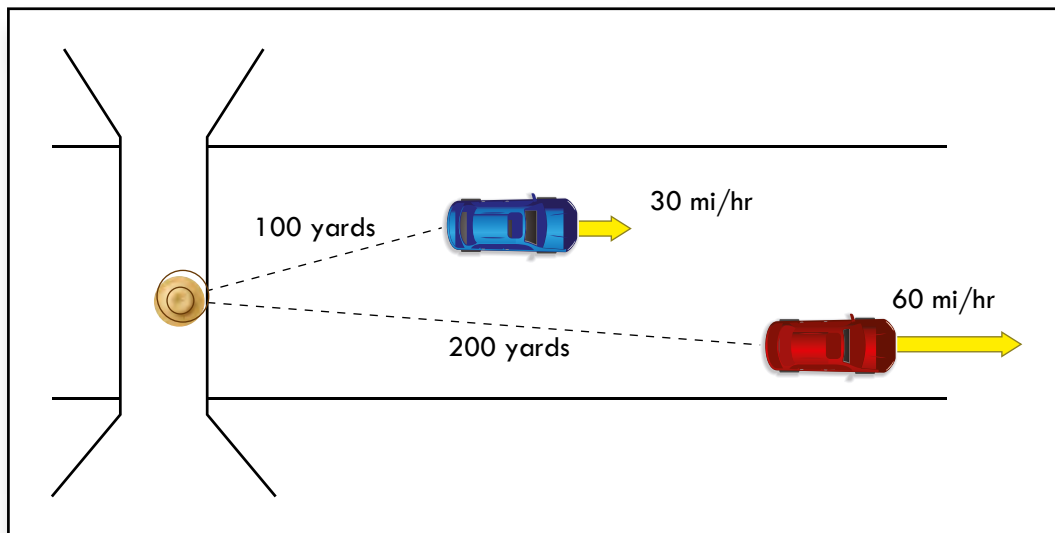


If we were to graph all of the galaxy distances and speeds, we would find there is a fairly strict proportionality. The further away a galaxy is, the faster it's going. The relation is linear, as shown in Figure 7.

Now think about what this means. Suppose you are standing on a freeway bridge. Here is the freeway in Figure 8, there is the bridge, and that's you wearing a large straw hat.

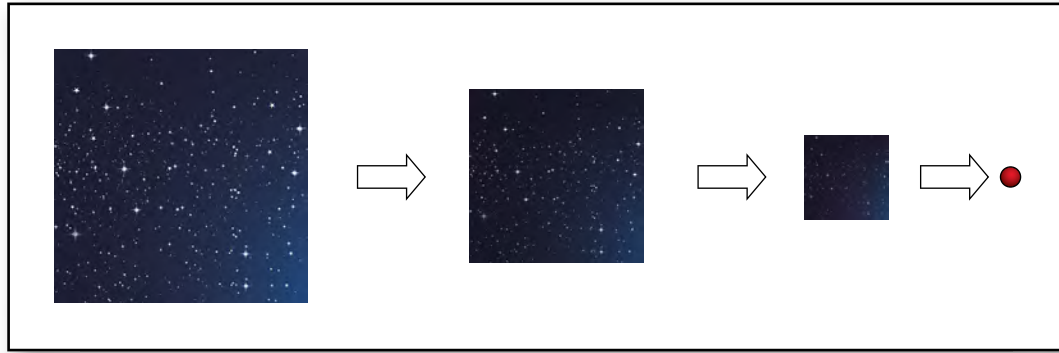


**Figure 7.** A Plot of the Hubble Relation. The red dots represent the galaxies used by Hubble to calibrate the relationship. The other empty dots are extensions to higher redshift.



**Figure 8.** The Speed Is Proportional to the Distance Away

You're looking down from the freeway bridge, and you see two cars, one of them a hundred yards away in the left-hand lane going thirty miles/hour (this must be a freeway in Salt Lake City). And then there's another car that's twice as far away, going twice as fast, sixty miles/hour. Now, there's something really important about this linear relationship if you think about it. The one twice as far away is going twice as fast. You can see what this tells us about those two cars by running time backward. The car twice as far away backs up at twice the speed, and this means that they both arrive back under the bridge at the same time. So, as I look at these two cars that are now going away from me, I know that there was a time when both those cars were under the bridge together. Similarly, as I look out at a universe filled with stuff that's moving away from me at a speed proportional to its distance, I know that if I back up time, there was a time when all of that stuff was together, right here in this room. That is the basis for the idea of the big bang.



**Figure 9.** *As we back up time, a block of space and matter in the present universe gets smaller and smaller until it shrinks to a point, the initial big bang point.*

### The Big Bang

If we take a little cubic chunk of the universe with matter and stuff in it, we can say that it has this size at the present time (Figure 9). Then, backing up the expansion, we see that the matter in this chunk must have had a smaller volume a little while back. Then it was smaller still before that, and as we go back in time, this little piece is shrinking and shrinking. Finally, the cube shrinks to a single point. Everything in this piece of the universe began at one point in time and at one point in space, and it was right here in this room.

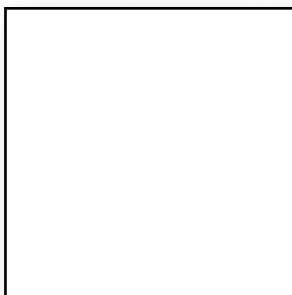
But this still leaves one important question. Where did this one little red point come from? Most Catholics and Protestants were delighted with this question, because they had a beloved idea just waiting for a problem like this. Their idea is that God, who exists outside of space and time, created this little fireball out of nothing. Before I go on with my story, I would like to take a short aside on this subject.

### An Aside on Creatio Ex Nihilo

I know we like to preach and defend our own doctrine and not criticize others' beliefs, but I can't help it: I've got to tell you a few problems I see with this, a few things that have just driven me crazy that no one else seems to worry about. Try this: "God, who lacks nothing, needs nothing, desires nothing he does not already have, nevertheless creates a universe and people who live in it." Why would he do that? Or what's worse: "God loves good and hates suffering, yet the result of his action is that most of his creations will suffer forever, eternally shut out from his presence." Why would he do that? That seems mean, and God should not be mean. And finally — and I don't know if this one bothers you, but it really bothers me — "And he makes it all so big." Why would he *do* that? Well, I've never heard a good answer to any of those questions. But let's get back to the story.

## The Origin of the Universe

So, where were we? Right, we were looking at the little red dot in Figure 9. Where did this single point come from? It's a valid question, and it ought to have an answer. Scientists who are atheists cannot just attribute the big bang to God. So what is their explanation? Well, here it is, written out for you in Figure 10.



**Figure 10.** *The Best Explanation of Big Bang Origins*

Right. Blank. There is no answer. They ... well, they're not quite sure ... but maybe it came from, uh, a quantum fluctuation in, well ... in *something*. I don't really mean to make fun of anyone because this is actually a very hard question, and the serious answer is that no one has a good solution. Everyone agrees it is a valid question, and scientists are concerned about it, but no one has a compelling answer. But there is one thing on which everyone agrees, Catholic, Protestant, and atheist: Joseph Smith was wrong.

Let me give you an example. Several years ago, a book came out called *The New Mormon Challenge*. It contained a chapter by Paul Copan and William Craig titled "Craftsman or Creator: An examination of the Mormon Doctrine of Creation and a defence of *Creatio ex nihilo*." Copan and Craig addressed Joseph Smith's cosmology roughly as we have just presented it and then compared it with modern cosmology. They found a conflict. The authors express it this way:<sup>8</sup>

The Big Bang represents the origin of all matter and energy, even of physical space and time themselves, as we have seen. Therefore, it is irreconcilable with the theory to hold that matter/energy are eternal or that God is the physical product of a beginningless progression . . . Thus, Big Bang cosmogony is a veritable dagger at the throat of Mormon theology.

I particularly like the "dagger at the throat" remark.

Let us summarize in Figure 11 the cosmology that Copan and Craig depended on for their conclusions. In the post-1930 big bang theory, matter would not be conserved through the big bang. If there was a big bang, then whatever pre-existed the big bang was not matter. And, if there was a big bang, the universe may still have been infinite in size, but it was certainly finite in time. It was not eternal.

So, wow. It looked like Copan and Craig are correct and that the Mormons were in trouble with science again.

However, we should explain that *The New Mormon Challenge* was published in 2002, and when it appeared, it was already twenty years out of date in at least one important way. The problem with the book, as with the views summarized in Figure 11, is that it had been known since the 1970s that there were big problems with standard big bang theory. Let's see what they were.

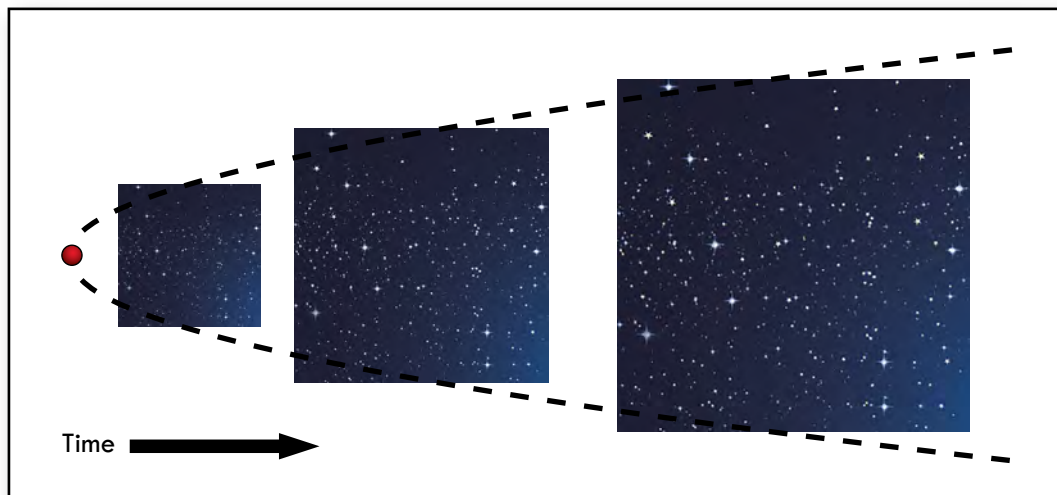
### SCIENTIFIC COSMOLOGY: POST-1930

- MATTER IS CONSERVED, EXCEPT AT THE BIG BANG
- EVERYTHING IS MATTER, EXCEPT BEFORE THE BIG BANG
- THE UNIVERSE MAY BE INFINITE, BUT IT IS NOT ETERNAL

**Figure 11.** *Elements of Scientific Cosmology in the Period Post-1930*

### Cosmic Evolution

Let's begin by looking more deeply at cosmic evolution. The evolution of the scale of the universe is governed by Einstein's equations of General Relativity. These equations determine the distances that will be measured between galaxies that are at rest relative to the space around them. The solution that fits our present universe describes a universe that is filled with matter, and it tells us that all of the space in the universe begins by expanding rapidly and then slowly decreasing its expansion rate due to its self-gravity. If we begin at a single point, the solution for the block of matter we live in is consistent with the sequence of pictures shown in Figure 12. It begins at the single red point in the picture, expands swiftly at first, and then more slowly as time goes by. The dashed lines show the relative scale size of this block of the universe.

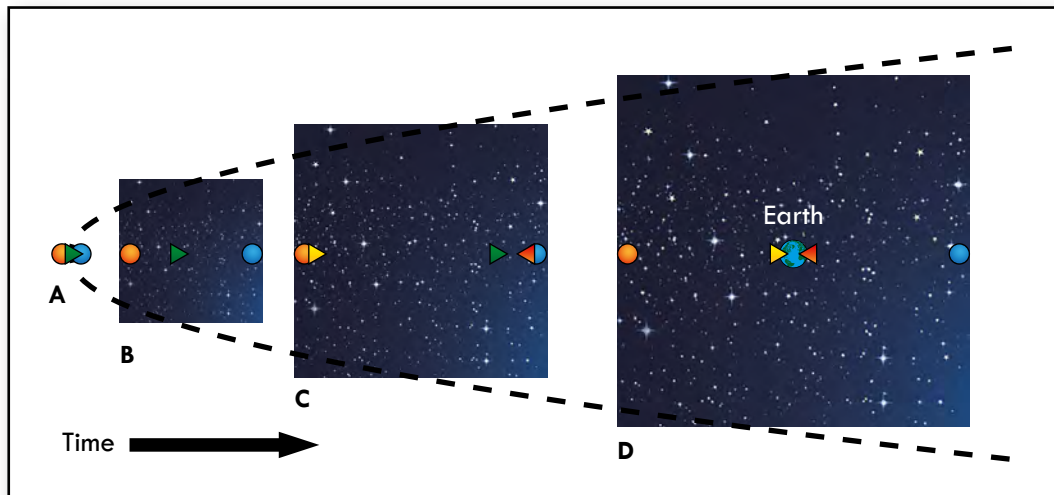


**Figure 12.** *The visible universe begins at a single point and expands, rapidly at first then slowing its expansion due to its own self-gravity.*

### The Horizon Problem

But as I mentioned, there are three or four big problems with this picture. One of these is actually fairly simple to understand, so let us concentrate on it. It alone is enough to demonstrate that the simple big bang theory depicted in Figure 12 predicts a situation that is not observed in nature, thereby disproving the theory. The problem is referred to as the “horizon problem.”

To see how it arises, let me take you through Figure 12’s expansion scenario again. This time, we want to consider the orange and blue dots in picture A of Figure 13. These represent pieces of the initial big bang that will fly apart to different places in this block of the universe. Let’s say that each one will eventually form a galaxy, and let’s say that the expansion is so fast that the distance between these two galaxies increases at twice the speed of light. By the way, you may have heard that nothing can go faster than the speed of light, but this does not apply to the cosmological expansion we’re talking about here. Trust me on this. Everyone knows it’s right.



**Figure 13.** Picture A is the big bang. In picture B, a photon is moving from left to right. In picture C, when the green photon has not yet reached the blue galaxy, a red photon is sent from the blue galaxy toward the left. Also shown is a yellow photon that is simultaneously sent from the orange galaxy toward the right. In picture D, both photons arrive at the earth and we see the light from the two galaxies.

Still looking at picture A, let’s also note the little green triangle that represents a photon, a piece of light. It leaves the orange galaxy at the big bang and heads toward the blue galaxy. The photon, of course, moves at the speed of light. In picture B, the two galaxies have expanded away from each other and the photon is working its way toward the blue galaxy, but it has not yet arrived there. By the way, the reason it is further away from the blue galaxy than when it started is that the photon is only going at the speed of light, while the blue galaxy is receding from the orange galaxy at twice the speed of light. However, because the photon in picture B is now between the orange galaxy and the blue galaxy, the distance from the location of the photon to the blue galaxy is increasing at less than twice the speed of light. If we

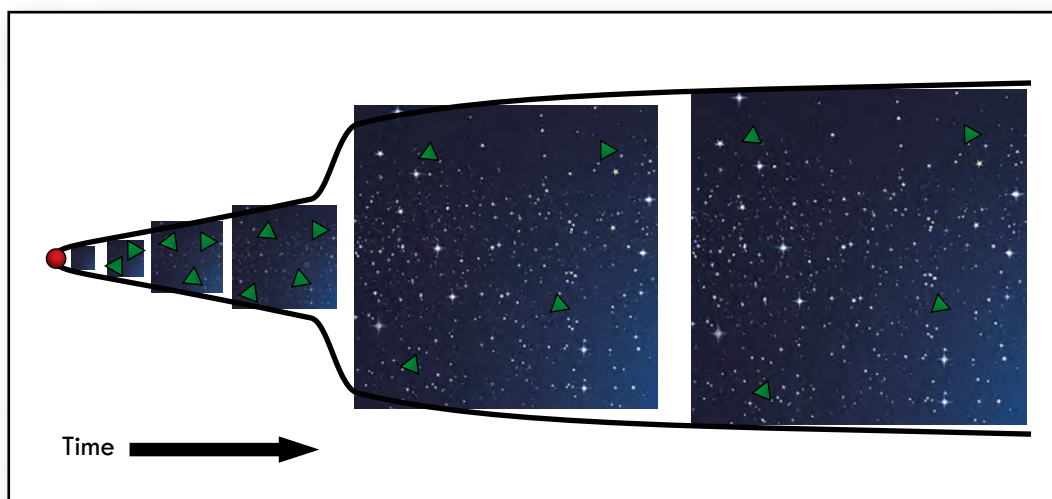
wait long enough, the little green triangle representing the photon will eventually get to the blue galaxy. In picture C, where the green photon has still not arrived at the blue galaxy, we see the blue galaxy sending a red photon toward the left. The information carried by this red photon is a picture of what the blue galaxy was like at the instant the photon left. And let us be clear that this is a time before the green communication photon from the orange galaxy can have arrived at the blue galaxy. At the same time, in picture C, the orange galaxy sends a yellow photon toward the right, carrying information of conditions in the orange galaxy at the moment the photon was sent. Finally, in picture D, both signals arrive at earth and show us both galaxies as they were at the time of picture C.

Let us think what this all means. If we are on Earth in picture D, and if we look in the two directions that are 180 degrees apart, we will see the orange galaxy and the blue galaxy as they were at a time before they could have had any communication with each other. No little green photons could have transmitted any energy from one to the other. This is what we actually see in the real world as we look into the sky in different directions from Earth. We see parts of the universe at a time when they can have had no communication, no exchange of energy, between them. And yet, no matter which direction we look in our real universe, we see that everything is at the same temperature to five decimal places. This is the basis for what's called the horizon problem. It's a big problem. The big bang is this big random chaotic event. It cannot produce a uniform temperature by itself. Unless these two pieces of the universe are able to exchange energy and come to equilibrium, they can never end up at a single temperature. And yet the temperatures we see are the same everywhere. The simple big bang theory is not supported by observation.

### **Inflation**

The solution to this problem, and to many of the known problems of the simple big bang theory, is to postulate an effect known as inflation — inflationary cosmology. The solution to the horizon problem comes about in this way.

In inflationary cosmology, it is assumed that our local block of the universe begins by expanding very slowly, as shown in Figure 14. During this initial period, there is plenty of time for photons to be exchanged between bits of the universe. Then, after what is still a relatively short time, the universe suddenly begins to inflate, to accelerate its expansion rate by a huge amount. This has the effect of driving the pieces of the universe that were long close together out to the enormous distances where we see them now. The universe comes to thermal equilibrium during the slow expansion phase, before the inflation drives it to scales so large that the pieces would no longer be able to equilibrate over the entire block. But they don't need to. As we look in different directions in the sky, we see parts of the universe that were in communication early on, allowing them to exchange energy many times. So it is no surprise that they are now at the same temperature to five decimal places.

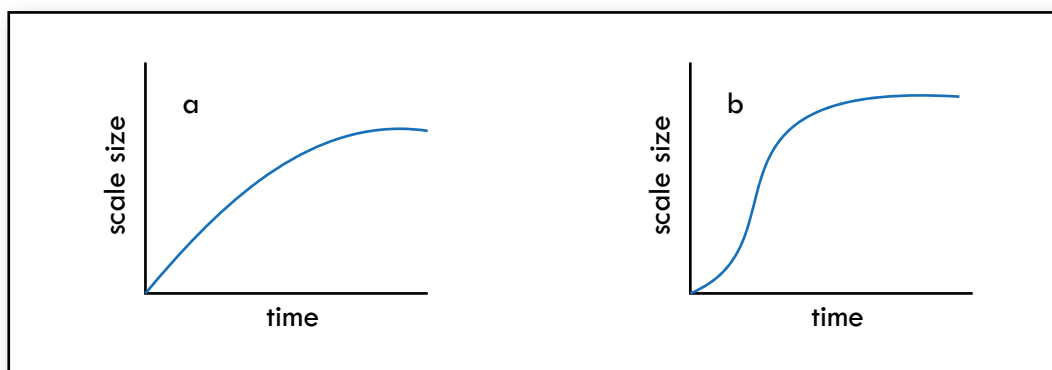


**Figure 14.** *An Inflationary Cosmology.* During the initial slow expansion, pieces of the local universe interact many times via the green photons. Then, once inflation starts, it separates these pieces to the huge distances we see today.

### So What?

Here is one of my favorite questions: “So what?” Haven’t we just replaced a simple big bang (Figure 15a) with a more complicated one (Figure 15b)? Isn’t there still a single creation from something out of nothing when time begins?

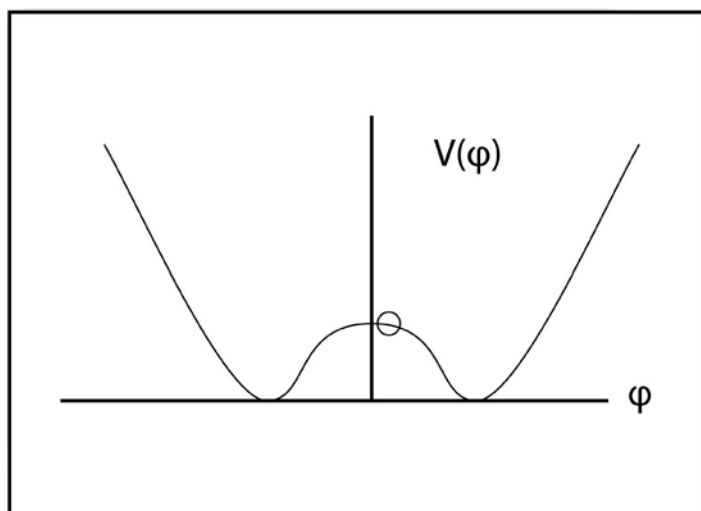
You will be interested to find out that the answer is a definitive no.



**Figure 15.** *Graphs of Standard Cosmology (a) and Inflationary Cosmology (b).*

### The Inflaton Field

Here is the reason. Inflation has to have a mechanism. Typically, this mechanism is taken to be the existence of a scalar field called the “inflaton.” This is a field whose potential energy is given as a function of its field strength in Figure 16. We assume that the field starts off in the false vacuum state near  $\phi = 0$ . Then, as time goes on, the value of the field slowly rolls down to the true minimum of the potential energy curve. During the slow roll, it produces inflation. Quantum mechanics can also allow the value of the field to fluctuate a little bit and restart the slow roll.



**Figure 16.** *The value of the inflaton field  $\phi$  starts near zero in a false-vacuum with a potential energy  $V$  that is not at its absolute minimum. As the field rolls toward the true minimum, it fuels inflation.*

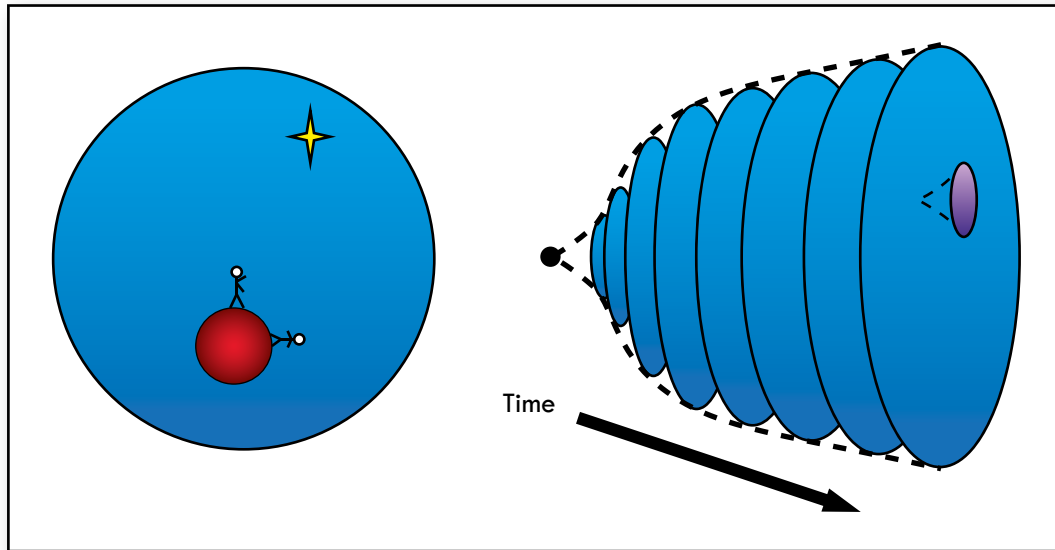
The point of this explanation is that some mechanism like this has to exist in an already-existing universe for inflation to have taken place in our universe as its initial slow expansion phase ended and the inflationary epoch began. And there is no change in the laws of physics, so that mechanism must still be available in the universe today. Thus it should still be possible in our own universe for this inflation to take place again, starting from some small region of the present universe. Let's see what this implies.

### Eternal Inflation

Figure 17 depicts the expansion by using a two-dimensional analog to our actual three-dimensional universe, so that we can see the sequence spread out in time. To see what we mean by a two-dimensional universe, consider first the blue disk at the left of Figure 17. This disk represents a section of a two-dimensional universe that stretches away in all directions in the plane of the disk. To use this picture, you pretend that there are only the two dimensions of the disk. Lines not contained in the disk are lines that leave the universe, and so they cannot exist. In this two-dimensional analog to our three-dimension universe, the spherical earth would be a small disk, the inside of the disk being the interior of the earth. We would be little two-dimensional figures who run around the outside of the disk. We can point down toward the center of the earth, or we can point up toward flat stars in the blue universe, but we may not point out of the blue surface because that direction does not exist.

The picture on the right of Figure 17 depicts the expansion of an inflating universe. The universe is represented by these little flat disks, each one a two-dimensional universe. The increase in the size of the disks from left to right represents the universe's expansion. The evolution of the scale size is shown by the outside dashed lines. It begins at the cusp at the left, representing the big bang. There is a slow expansion to begin with, then a sharp increase in scale size followed by a slow coasting and slight reduction in the rate of growth. The last blue disk on the right represents the universe we now live in, some 13.7 billion years after the beginning.



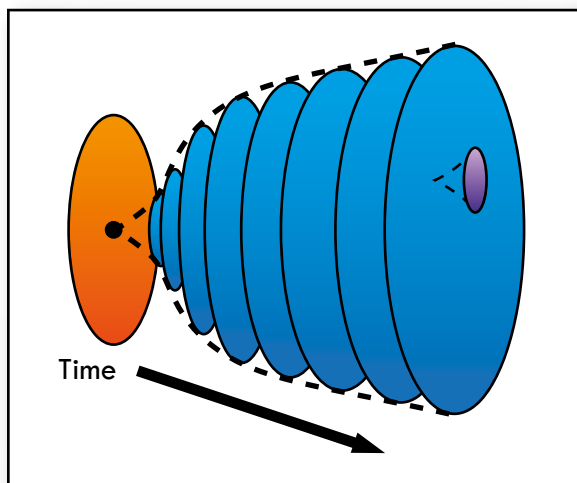


**Figure 17.** The blue disk on the left represents a section of a two-dimensional universe with planets as disks and flat stars. The sequence on the right shows an inflating two-dimensional universe in which a daughter universe begins from a new inflation.

The point we want to make about inflation is shown on the last disk. Because the inflationary mechanism must still be available at each time point in the existing universe, a new inflation could begin in any one disk. In particular, it could occur now, the point represented by the last blue disk. A part of our own universe could suddenly inflate, creating new space at a rate faster than the speed of light and thereby cutting that new region off from any communication with our own universe.

If that could happen in our present universe, and the theory says that it could, then let's think again about the big bang cusp in Figure 17, the dot that represents the point from which our universe began. It could be that we are not the first space that ever inflated. In fact it's pretty likely that our universe, the result of our little

big bang, was originally a small region in a previous universe, the orange universe in Figure 18. So our big bang was not a creation of the universe from nothing at all. It could be that it was just another inflation event in another pre-existing universe.

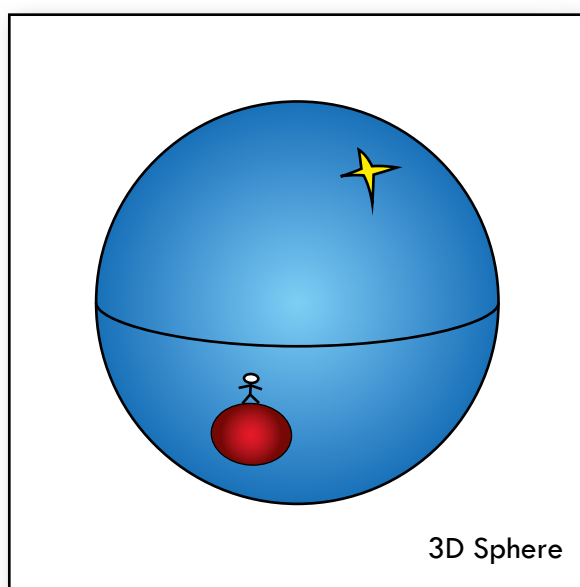


**Figure 18.** Our own universe may have begun as an inflation event in a parent (orange) universe.

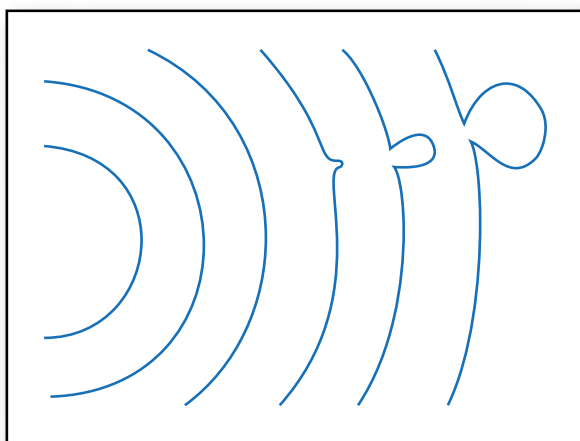
Now, unfortunately, the inflation pictures in Figures 17 and 18 make it look like the inflating spaces, the pink disks in Figures 17 and 18 and the blue disks in Figure 16, must either overlap the parent spaces that spawned them or must

shove the parent space aside to make room for the new inflating space. That doesn't happen. To show what does happen, we're going to need another way to visualize the creation of a new inflating region of space.

We are going to look at another two-dimensional analogy to our three-dimensional universe, but this time, instead of using a flat surface like the disks in Figures 17 and 18, we are going to use the two-dimensional surface of a sphere. Even though a sphere is a three-dimensional object, the surface is still two-dimensional, since it only takes two numbers (longitude and latitude) to specify every point on the surface. The universe is the surface here, not the whole sphere, so the inside of the sphere and the space outside it are not part of the universe; they do not exist in the analogy. Figure 19 shows such a two-dimensional space, with a small disk for the earth, flat people on the earth, and a flat star shining far off in some direction.



**Figure 19.** A two-dimensional analog to the universe where the surface is the two-dimensional surface of a sphere.



**Figure 20.** The creation of a bubble universe by rapid inflation in a background, uniformly expanding universe.

Although we are considering a two-dimensional universe in the figure, we actually live in a three-dimensional universe, so we can use the extra dimension to picture the universe expanding like a balloon that is being blown up. Unfortunately, a sphere is a closed figure, so we can't picture this on the page. So, instead of drawing the entire surface of the sphere, I'm just going to draw the edge of this sphere. This way, we can watch it as it expands. This is shown in Figure 20.

The first three semicircles represent the radius of the sphere increasing at a uniform rate. But in the fourth circle, we see a dimple start to form. This growing bump results from an expansion rate in a small region of the universe that suddenly becomes greater than the uniform expansion of the rest of the sphere. The growth of the bump does not interfere with the expansion of the rest of the space; it just creates a bubble on the balloon, a small bump on the otherwise uniformly expanding background surface. As the bump

grows, this super-inflating piece of the surface produces its own new space, a new “bubble universe.” If the size of the bubble is great enough, the speed at which new space is created can be much greater than the speed of light, thus recreating the situation we see in our own universe at the present time.

So as far as we know, our own universe may not be the one that started out in the first three semicircles of Figure 18, but it might just as well be the little bubble universe that grew from it. In his case, our universe would not have been the first universe to form. And of course, our parent universe, the one that spawned us by the sudden inflation event, need not have been the first universe ever formed, either. It might itself have arisen from an inflation event in its own parent universe.

This sequence of parent and daughter universes has no reason ever to have had a “first universe” event. Indeed, the infinite sequence allowed by such an inflationary mechanism has been given the name of “Eternal Inflation,” and the infinite collection of parent and daughter universes is called the “multiverse.”

### **Zero-Energy Universe**

Now suppose that a little one-foot-diameter sphere right here in this room were to experience a sudden quantum fluctuation in the value of its inflaton field to a non-vacuum value and then begin to slow-roll back to its true vacuum state, driving this space to inflationary expansion. We have said that this could produce a new bubble universe. But since there is not much matter inside this little blob of air, how could a universe full of matter be created? Where would the matter come from?

One of the goals of cosmological observations over the last several decades has been to determine the average density of matter-energy in the universe. This is critical because the size of the universe, whether finite or infinite, is determined from Einstein’s equations, with the average density as the crucial parameter. And one of the results that has become increasingly clear as time goes on is that the observed density is outrageously close to what is called the “critical density.” At the critical density, the universe is just barely infinite in size. So it appears from observations that our universe is actually infinite.

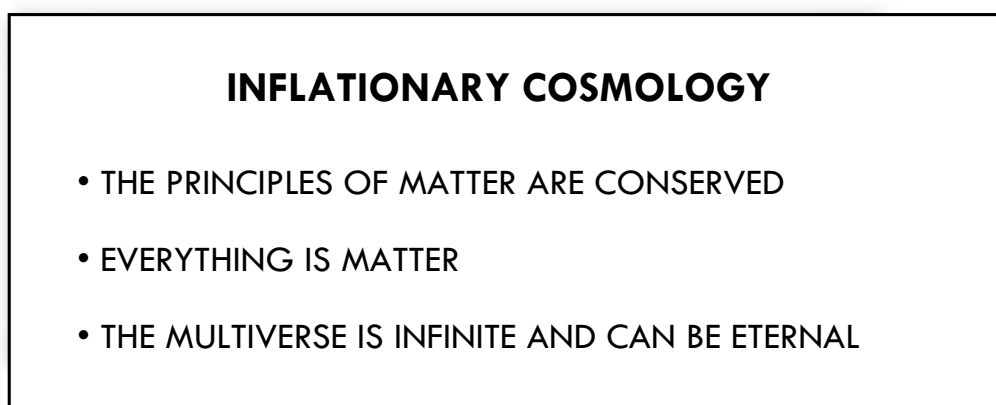
But this density has another special property. At the critical density, we have a case where the positive energy of all the matter in the universe is just exactly balanced by the negative gravitational potential energy that binds the universe together gravitationally. This balance is not a coincidence but arises naturally in inflationary cosmologies. Since this balance means that the total energy content of the present universe is zero, the energy required to fill an inflating universe with matter is zero. The matter arises naturally as the result of the newly-created negative gravitational energy spawning positive mass-density energy. This outgrowth of inflation that occurs in a universe with the critical density is termed the “Zero-Energy Universe.” A chapter in a recent book by Pasachoff and Filippenka expresses it like this:

The idea of a zero-energy universe, together with inflation, suggests that all one needs is just a tiny bit of energy to get the whole thing started (that is, a tiny volume of energy in which inflation can begin). The universe then experiences inflationary expansion, but without creating net energy.<sup>9</sup>

The thing required for positive energy to be created in the inflation process is the principle that the initial zero total energy is conserved. The matter is not created out of nothing but rather out of the principle of conservation of energy. As we said, the modern name for this creation of matter from pure energy is “zero-energy universe,” but it might be said equally well in other words that there is a pure principle of element at work. Total energy is not created or destroyed, but positive matter energy is created as the negative gravitational energy of the matter appears.

### Joseph Smith and Inflationary Cosmology

So let’s see where this leaves us. Figure 21 summarizes the elements of an eternal inflation universe with an exact zero-energy condition producing the critical density of matter.



**Figure 21.** *Elements of Inflationary Cosmology*

Not bad for a young Mormon boy in 1840. But let me be clear. I am not suggesting that the lack of a case for a conflict between modern cosmology and Joseph Smith’s cosmic teachings is evidence at all for his prophetic calling. There are far too many assumptions on my part in this discussion and far too little agreed on among cosmologists for that to be the case. But it is clear to me that there is absolutely no good case against Joseph Smith from modern cosmology. There are reasonable ways to harmonize the two sets of doctrine, and naive big bang challenges to the doctrines of the Restoration are out of date.

### Full Disclosure

However, full disclosure requires me to tell you that there are three little problems with this picture that I’ve given you, interpreting Joseph Smith’s cosmology in light of our modern understanding of inflationary cosmology. All three of the problems revolve around the same basic conflict between physics and LDS theology.

The first of these is a technical challenge to the idea of eternal inflation itself. In 1994, Bordé and Vilenkin<sup>9</sup> claimed to have proven that the multiverse has to have a beginning. They showed that timelike worldlines, paths through space and time for particles that travel slower than the speed of light, cannot have infinite length into the past. There must have been a beginning. So Joseph Smith looks like he may still be in trouble here. It is important to note, however, that many cosmologists do not agree with the conclusion of the Bordé-Vilenkin proof. The proof makes many assumptions. It is not clear that the proof works in a zero-energy universe or that the finite-length calculation Bordé and Vilenkin do actually addresses the question of whether or not there is a beginning to the universe.

There is another sort of related problem, anyway, if we want to put God into this picture. It is this: Since most of this little bubble universe is expanding faster than light, how does God get into his new universe, and how can he travel around inside of it, because nothing can travel faster than light?

And finally (actually, this sort of bothered me when I was younger), since nothing — no signal, no information — can ever travel faster than light, how does God answer my prayers?

All of these problems arise if there is an absolute speed limit — the speed of light — on all signals and travel. The speed limit strengthens the Bordé-Vilenkin proof; it limits God's ability to visit all of his universe, and it violates my own experience that God answers my prayers immediately. Well, contrary to popular opinion, even among physicists, things can travel faster than light.

The explanation for this is a little more technical than what we have been discussing until now, so I have decided to put it into an appendix at the end of the paper. You can either trust me on this, or you can go and follow the argument yourself.

### Summing Up

Let me end by reiterating my two main takeaway points.

First, don't forget your quiz question. Remember that we may expect apparent conflicts to arise between science and our LDS religion because scientists can misinterpret what they see, and Mormons can misinterpret what they read.

The second point is the one from my story about the Dark Energy Task Force. It is that this is no time for anyone to criticize anyone else's beliefs based on what *cosmologists* know.

### Questions

**Q:** “Why should we believe that dark matter exists when there is no evidence? And is it not more likely that our understanding of gravity is incomplete?”

**A:** There is plenty of evidence for dark matter, or no one would believe in it. However, it is certainly possible that the problem lies in our understanding of gravity. A lot of very smart people are looking at possible alternatives to the theory of gravity as an explanation for the apparent effects of dark matter on the dynamics of the galaxies and of the universe. But remember that whatever theory you suggest as an alternative has to be “complete.” That is, it has to exactly reproduce all the things that we know gravity predicts correctly and then has to give us something else to solve the dynamics question.

Let me elaborate a little. The presence of dark matter is obvious from cosmological observations. As the universe expands on the largest scales, the medium-scale contraction of clusters of matter and the size and evolution of the resulting structure as seen in the observations of the early universe leads us to say that there must be a component of matter that we cannot see. It has to have about four or five times greater density than the matter we can see. No one knows for sure what form or forms it would take. A lot of searches have been made, looking for various possibilities that have been suggested, but none of them have been successful at finding evidence for that particular form. But the evidence from the expansion and the clustering is clear, and so everyone agrees that it has to be there.

**Q:** “Would theories and understanding of quantum mechanics advance if scientists realized that energy is alive and applied principles of biology to the studies?”

**A:** I don’t know. I’d have to understand what that question is really about. So, if you want, come grab me, and I’ll try to respond to the question.

**Q:** “Is it possible that the big bang occurred from the death of a previous universe?”

**A:** There is a cosmological model that says there was a big crunch in a previous universe that brought everything back together, and then there was a rebound. I know the guy who first invented this theory. It’s viable but not compelling. The question was “Is it possible?” The answer is yes.

**Q:** “The universe is filled with galaxies. What is outside the universe?”

**A:** There is no outside the universe. If the universe is infinite, then there are galaxies as far as you can go in any direction. If the universe turned out to be finite (and I really don’t want to go into that), then as far as you can go out in any direction there are galaxies. The only difference is that if you go far enough in a finite universe, you end up back here at this podium. There is no outside. In any direction I can point I can tell you everything that’s there, finite or infinite, curved or not.

**Q:** “Could the black hole have something to do with the bubble caused by universe inflation. That the black hole is where the birth of the universe came from?”

**A:** A black hole is a solution of the Einstein equations. There are a number of ways that you can think of it physically, ways that the geometry of a black hole might come about. In a sense, you could argue that the singularity at the beginning of the universe is associated with a black hole. But it doesn’t fulfill a lot of the geometrical requirements of black holes. I guess I can’t give a very good answer to that. My best answer is “I don’t think so.”

**Q:** “Why does the universe seem to be expanding in every direction from us? Do we just happen to be at the center or does it have something to do with the fact that we are doing the looking?”

**A:** If I had more than five minutes, I actually have a nifty little slide here that answers that question. But let me summarize: let’s assume I’m on one side of the universe and I see the universe out there. Something a long ways away is moving fast, something that’s close to me is moving slower, and everything is proportional. I would see that everything is moving away from me. But if I went over and stood on one of those galaxies, I would see this room moving away from that galaxy. If you look at the details, every galaxy would be moving directly away from me when I am over there as well as it does when I’m here. So this case of proportional expansion means that every point in the universe is expanding away from every other point.

**Q:** “What about the possible unreliable accounts of Joseph Smith’s discussions about moonmen and sun-men?”

**A:** I don’t know. But, if Joseph Smith actually said this, he probably learned it from the great British Astronomer, William Herschel, not from God. Herschel taught, long before the days of Joseph Smith, that the moon was definitely inhabited and that the sun probably was as well.

**Q:** “Do you see any correspondence between information theory increasing entropy and the Mormon idea of intelligence?”

**A:** I’m afraid I can’t think that one over in five minutes well enough to be able to answer it. I don’t see anything offhand, but I’d like to talk to whoever asked that question. It is an interesting question.

**Q:** “Quantum theory states that a positive-negative particle pair — a matter, anti-matter pair — can pop into existence out of the vacuum and then disappear again unless the pair appears near the event horizon of a black hole. Doesn’t this contradict the idea that matter is eternal?”

**A:** The energy that appears in virtual pair creation does not last for long. It must disappear again as the particles annihilate. But, if one of the particles goes into a black hole, the other remains, but at the expense of the energy of the black hole. So total energy is still conserved. This idea, by the way, is the basis for Steve Hawking’s

theory of black hole evaporation. It's a very well-respected theory and seems sound, but it is working in an area where the fundamental physics is very difficult to apply. And searches for evaporating black holes in the universe have so far been negative.

**Q:** "If everything is matter, what of the idea of perfect justice or perfect triangles or mathematic equations? These are clearly not material, what are they?"

**A:** They don't exist. These are concepts in the minds of men. If men quit thinking about them, the concepts go away.

**Q:** "What about string theory?"

**A:** I had one slide that you should be glad I didn't show you. One of the other theories that I love is that instead of using inflation to solve the horizon and other big bang problems, Turok and Steinhardt had an idea they call the Ekpyrotic Universe. In this theory, the universe is really a ten-dimensional space. Six of the dimensions are curled up in a tight six-dimensional ball, and their only effect is to give us the Yang-Mills fields and the coupling constants. The other four dimensions are divided into a space of three dimensions (a three-dimensional membrane which is the universe we live in) and a fourth spatial dimension. In addition to our three-dimensional membrane, there are other membranes that exist side-by-side in the fourth dimension, and a universe is created when one of those membranes slams into the other and suddenly fills it with matter and energy. After this, it has all the earmarks of what we see in the universe today. This is a reasonable theory. And, by the way, the universe it predicts is eternal, it's infinite, and energy is conserved in it.

**Q:** "What's your opinion on the plasma hypothesis of the origin of the universe?"

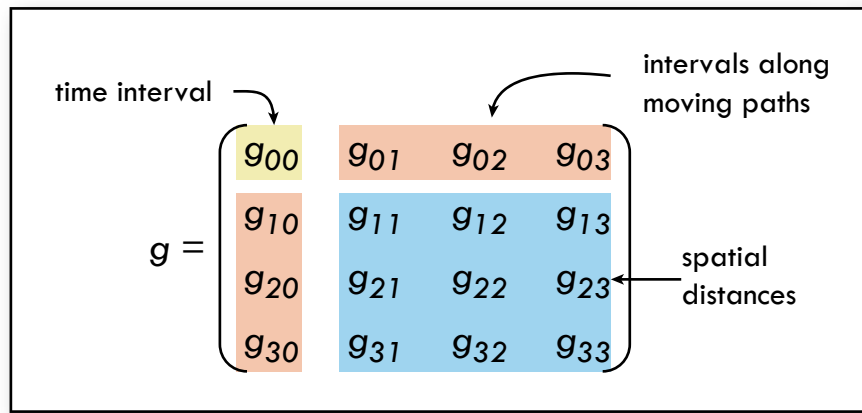
**A:** I think my time's up. No, I'd like to talk later to whoever asked that question. I know a little about the theory. It has some serious problems, the primary one being its lack of numerical predictions for most of the effects it is trying to explain. In physics, a viable theory has to be complete enough to completely explain the effects it wants to explain. This theory is not yet viable.



### Appendix: Hyperlight Travel in Two-Tensor Theories

The idea that things can travel faster than light is not generally known even by physicists, but the case is easily made and easily understood. Once it is understood how we are approaching the question, it is obvious to almost all physicists that this hyperlight speed is entirely possible.

Let us first consider the structure of space and time in normal physics. We begin by specifying a coordinate system centered on some object as origin and then locate the cosmic distribution of matter in this coordinate system. Based on the observed distribution of the cosmic matter, Einstein's field equations then determine the values of the sixteen elements of what is called the "metric tensor"  $g$ . These sixteen elements are shown in Figure 22. They determine the distances and times that will be measured between events whose coordinates we know.



**Figure 22.** *The elements of the metric tensor and what they measure.*

Thus, beginning with space-time coordinates for any two events, I can use the metric tensor to determine distances and times between them. This single yellow element in Figure 22 gives the time interval between two events. This little blue block tells me how to calculate spatial differences between points that are at rest, and these two little salmon-colored blocks tell me how to calculate space and time intervals along moving paths. Now, it is the nature of the way we define a coordinate system that I can always find one system that's moving at the correct speed to make the metric tensor end up looking like this:

$$g = \begin{pmatrix} g_{00} & 0 & 0 & 0 \\ 0 & g_{11} & g_{12} & g_{13} \\ 0 & g_{21} & g_{22} & g_{23} \\ 0 & g_{31} & g_{32} & g_{33} \end{pmatrix}$$



these signals that start from the origin must lie on the yellow light cone. Anything moving slower than light will have a world line that stays inside the light cone, and any world line outside the light cone represents something moving faster than light.

The laws that govern all the normal matter and fields we know have the  $g$  metric as part of their mathematical expressions. We say that normal matter “couples” to this metric tensor. These theories are experimentally verified, and it is part of these verified theories that no physical particle can have a world line faster than light. All real world lines must lie inside the light cone of Figure 23.

### The Spirit Sector

Joseph Smith told us that spirit is matter, but he also qualified that by saying it is also different. “More fine and pure,” he said. Joseph did not say that spirit matter coupled to a different metric, but he could not possibly have used those words in 1840 or even worried about a possible speed limit for spirit matter. So it is up to us to consider the possibility that there exists a second tensor in nature, one that likewise couples to the large-scale structure of the universe, but couples instead to the spirit sector of the universe — a metric tensor whose elements are determined by the distribution of spirit in the universe. Since we are supposing that this second metric tensor couples not to matter, but to spirit, then a framework arises in which the speed of spirit matter might not be not limited by the speed of light, as we shall see.

Let us call this spirit metric the tensor  $h$ , defined to have components like this:

$$h = \begin{pmatrix} h_{00} & h_{01} & h_{02} & h_{03} \\ h_{10} & h_{11} & h_{12} & h_{13} \\ h_{20} & h_{21} & h_{22} & h_{23} \\ h_{30} & h_{31} & h_{32} & h_{33} \end{pmatrix}$$

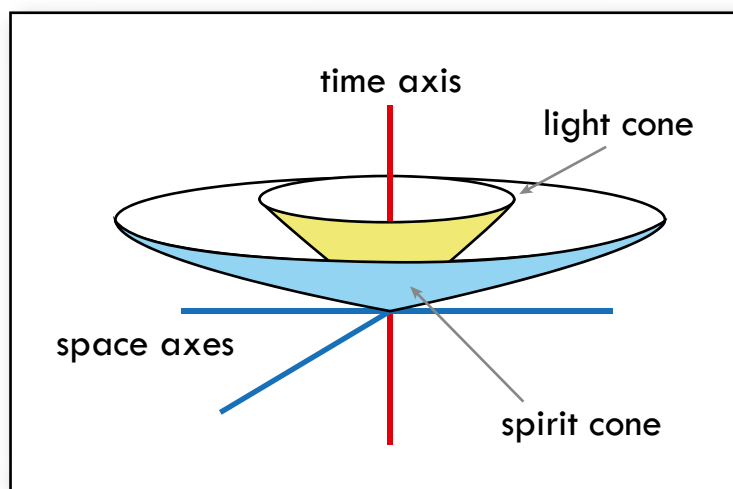
Now I can always find a coordinate system moving at one particular velocity that will simplify the spirit metric without changing the Minkowski metric (which, you remember, does not change if I transform to another frame moving at constant velocity relative to the first). The new metric can thus be made to look like this:

$$h = \begin{pmatrix} h_{00} & 0 & 0 & 0 \\ 0 & h_{11} & h_{12} & h_{13} \\ 0 & h_{21} & h_{22} & h_{23} \\ 0 & h_{31} & h_{32} & h_{33} \end{pmatrix}$$

That’s the best I can do with the freedom to change coordinates. But if it also happens that the spirit matter is distributed uniformly relative to normal matter, then by symmetry arguments, I know that the spirit tensor will take this form:

$$h = \begin{pmatrix} a^2 & 0 & 0 & 0 \\ 0 & -b^2 & 0 & 0 \\ 0 & 0 & -b^2 & 0 \\ 0 & 0 & 0 & -b^2 \end{pmatrix}$$

where  $a$  and  $b$  are determined by some kind of spiritual field equations and by the spirit density in the universe. In the case where  $a$  is greater than  $b$  — and that would be determined by equations that I don't know — then the counterparts of the light cones would be spirit cones with a speed that is greater than the speed of light. And so we would have a situation like Figure 24, in which spirit signals will travel along the wider blue spirit cone. All normal matter has to stay inside the light cone, but spirit, because it couples to a different metric tensor, could travel much faster than light.



**Figure 24.** The matter light cones (yellow) and the spirit light cones (blue) in the case where  $a > b$  in the spirit metric. Matter must follow world lines inside the yellow cone, but spirit can have world lines outside the yellow light cone.

So spirit communication has no speed limit. But you knew that, didn't you?

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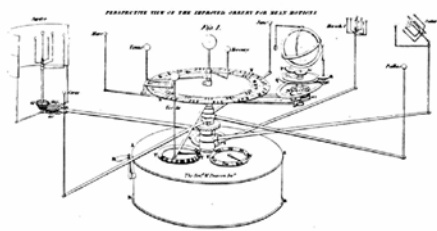
### Endnotes

1. Quoted in P. Davies and J. Brown, *Superstrings*, pp. 3-4. There is no known source for this quotation, so some have challenged its authenticity. This attitude, however, seems to underlie Kelvin's famous 1900 address to the British Society for the Advancement of Science. And similar thoughts were expressed by other well-known physicists of his time. In 1894, American Physicist Albert A. Michelson's judgment of the situation was, "it seems probable that most of the grand underlying principles have been firmly established." Michelson went on to add, in a likely reference to Lord Kelvin, "An eminent physicist remarked that the future truths of physical science are to be looked for in the sixth place of decimals." (Cited in J. Horgan, *End of Science*, p. 19.)
2. J. F. Smith, Jr., *Answers* 2, p. 191. "Following the Apollo moon landings and the death of President David O. McKay, President Smith became president of the Church. At a press conference following his assumption of Church leadership, he was asked by a reporter about this statement. President Smith replied: 'Well, I was wrong, wasn't I?'" (Personal reminiscence of David Farnsworth provided to FairMormon [21 November 2010]).
3. J. Smith, Jr., *Teachings*, 25 March 1839, p. 137.
4. *Ibid.*, p. 158.
5. *Ibid.*, 7 April 1844, pp. 351-352. Cf. J. Smith, Jr., *Words*, 7 April 1844, pp. 341, 345, 351, 359, 361.
6. J. Smith, Jr., *Teachings*, 16 June 1844, p. 373.
7. *Ibid.*, p. 353.
8. P. Copan and W. L. Craig, "Craftsman or Creator," p. 147.
8. J Pasachoff and A. Filippenko, *The Cosmos*, p. 532.
9. A. Bordé and A. Vilenkin, *Eternal Inflation*.

# THE OUTER SOLAR SYSTEM: A WINDOW TO THE CREATIVE BREADTH OF DIVINITY

Jani Radebaugh

In this chapter I want to tell you why I love the science that I study and the religion in which I believe. I hope what I write will help you appreciate the creative side of our Creator — and as you read along you'll get to see a lot of pretty pictures.

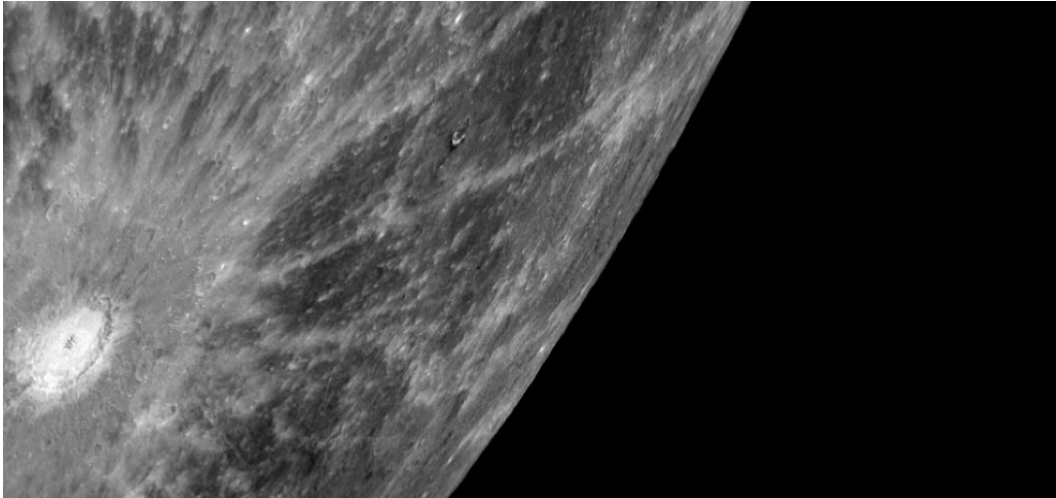


*Perspective View of the 1813 Orrery, 1830*  
William Pearson (1767-1847)



We begin our exploration with the inner solar system, which contains the celestial bodies that are closest to us. These are the bodies we understand best because they're the easiest to explore and study. We've been there for more than a half-century. The bodies of the inner solar system are also fascinating in their own right. Our nearest neighbor, the Moon, is a sort of black-and-white world, so when we look at it, we see a "grayscale"; we see a cratered landscape that's very old. Not much has happened to it since it formed four and a half billion years ago.

The same is true for the planet Mercury, which looks a lot like the Moon — so like the Moon that we see evidence of impact craters and lava flows. When we go to Mars, for example, we see impact craters, but we also see evidence of rainfall on the surface.



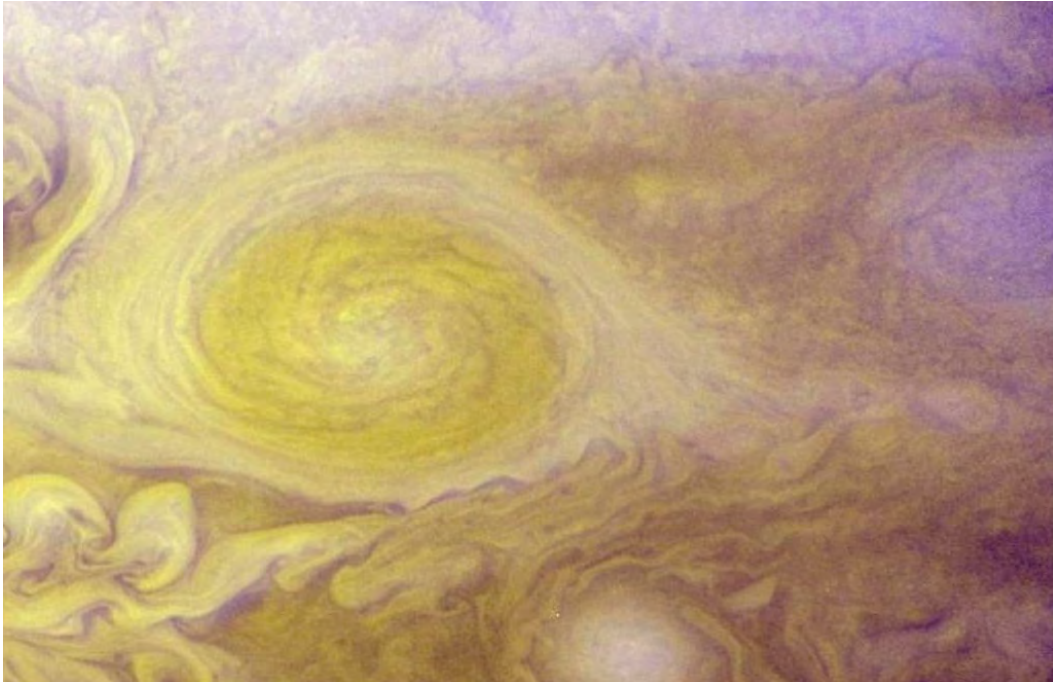


So there are some places on Mars that actually look a little bit like home, like what we could see in southern Utah, with dry river beds in a rust-colored landscape.

Can you remember the first time you saw a picture of Jupiter? The photograph above is from Pioneer 11, taken in 1974. The spacecraft had a camera thrown on it at the last minute because the scientists were not interested in pictures; they needed to take data of magnetic fields and things like that. But they did put some cameras on it, and all of a sudden a burst of color appeared when they started to look at Jupiter and the outer solar system. We could see beautiful clouds around Jupiter. The bands and the zones indicate the atmosphere is moving around. In the image above you can see Jupiter, and in the upper left corner is Io, tiny little Io, that I'll say more about below.

After this time, we began to appreciate the distant planets that are so beautiful and utterly alien to us. There's nothing imaginably like this on the Earth. Here we see a massive storm, and this storm is the size of the entire planet Earth. This is an image taken by the New Horizons spacecraft on its way past Jupiter to get a slingshot to head out to Pluto. It will arrive in a couple of years. On the next page, we can see a beautiful picture of a riot of clouds and storms in an array of patterns that result from an atmosphere that is so vigorous in its convection. Jupiter is so big that if we descend far enough down through its atmosphere, we'll reach a point at which the hydrogen in the atmosphere becomes a metal. There is so much pressure that the electrons are shed off the protons, and they move around at will. That's long before we get to the core, which contains rock and ice and metal.



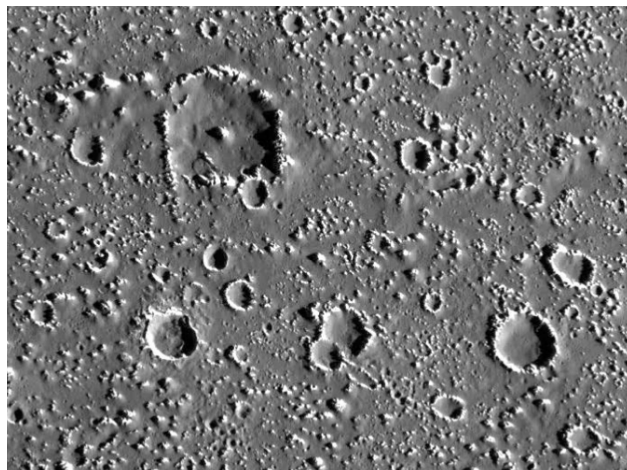


Another thing that's very interesting about these bodies is that they are beautiful in their own right with their atmospheres and their completely unique landscapes. Nobody ever thinks about living on Jupiter, but my twelve-year-old niece just wrote a short story about a girl who lives on Jupiter. You have to be a child to be creative enough to think outside of our experience and realize we could live there, and why not? She now has that story.

We look to the moons of Jupiter and Saturn and the other gas giants in the solar system for something that we can hold on to and appreciate. Our own moon and their moons have some similarities, yet each of these bodies are unique.

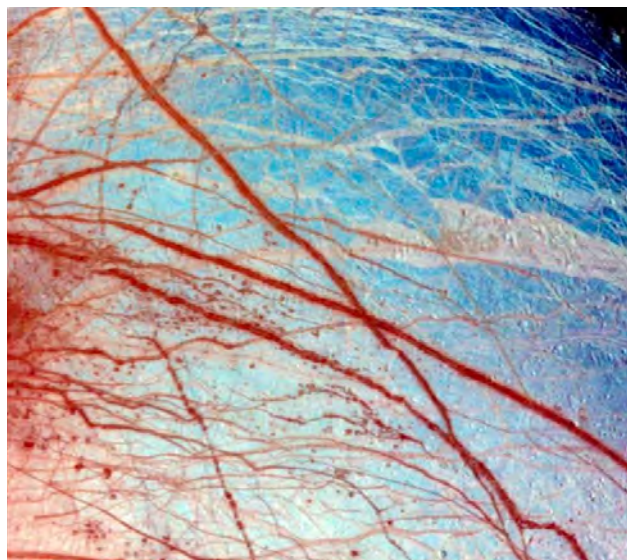
Four Galilean satellites of Jupiter are shown above. They're named for Galileo Galilei, who discovered them in 1610. They are shown here at the correct

scale — remember that the red spot you see here is the same size as Earth. Io is in the upper portion, on the very top; it's the same size as Earth's Moon. Imagine if you lived on Jupiter and could see this bright yellow and orange body in the sky instead of our own Moon. Ganymede is the largest of the group — larger than Mercury. A European spacecraft is going there in the next decade to study it. These are unique and exciting terrains to explore.



At left, you can see impact craters on Callisto, the farthest from Jupiter of all four of the Galilean satellites. These craters are somewhat different from those on the Moon. You can see their bright, shiny rims — they are bright because they're made of water ice. At these distances from the Sun, ice is actually a rock, and ice forms the crust of these bodies much like silicate rock does here on Earth. We

think of sandstones and other rocks as being the kinds of things that make up our crust, but on Callisto we have water ice; that's the crust, and it's covered in a layer of dust accumulated over many millions of years.

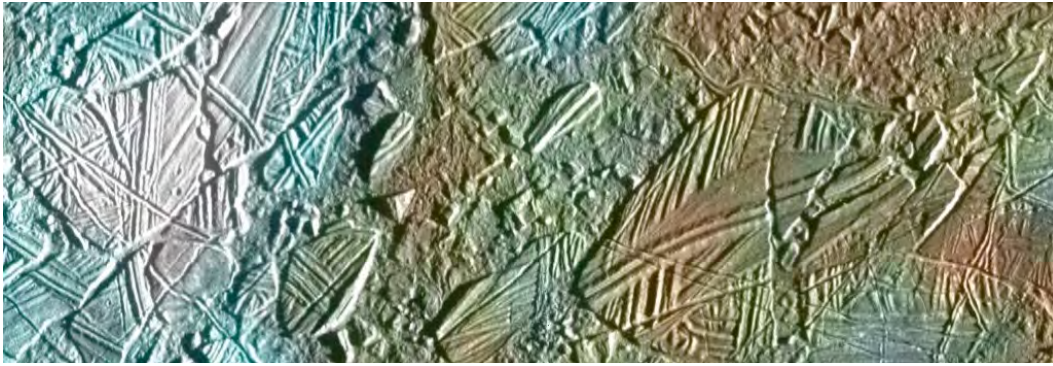


A little closer to Jupiter, we come to Europa, which is a little smaller than Earth's moon. It will be a unique and exciting place to visit someday. As we move out into the outer solar system, finding life or evidence of life having started will be a focus of interest. Where are the impact craters on Europa? There are not very many — the surface is very young, just a few million years old. We know this because the ice melts, overturns, or gets broken up by the tectonic

processes that you can see as having happened. You can see the crust is split apart, and there are salts that have come up from an ocean not far below the surface. This is a liquid water ocean, and we think the ocean is connected with a seafloor.

On the next page is a close-up. This looks something like polar sea ice, doesn't it? If you work hard you can figure out a way to reconstruct the original positions of all the plates, and you can even pick out a zone that you might call a slushy

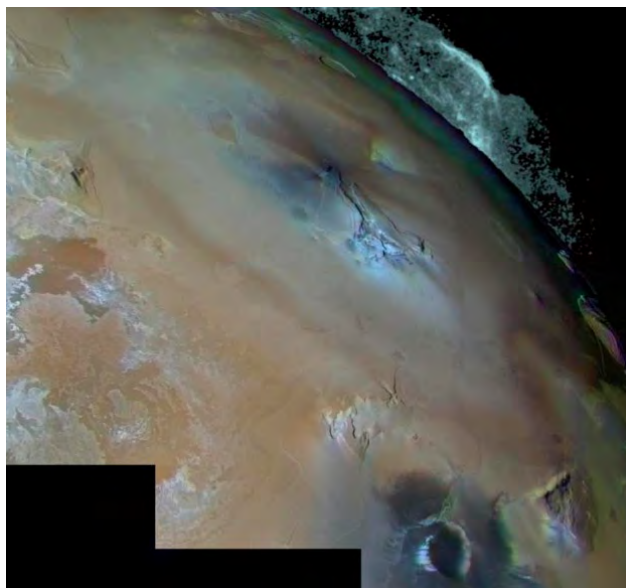




zone. We think this is solid ice now, but at some point in the past — perhaps the not too distant past — it was a slushy melt that enabled the ocean to accumulate on the surface. If we go down far enough, we might find deep sea black smokers on the bottom of this ocean, and this is one of the locations where scientists are thinking life might have gotten started on the Earth. So now we have a similar environment; we have the energy to drive these seafloors from Jupiter tugging on Europa. Sometimes Europa is little closer to Jupiter, other times it's farther away, and so can it can be stretched and kneaded, which creates a lot of internal heat, so maybe we have little volcanoes on the seafloor. This is a very exciting place for us to think about, trying to find evidence of life started somewhere far away from Earth. This is five times as far from the Sun as the Earth is.

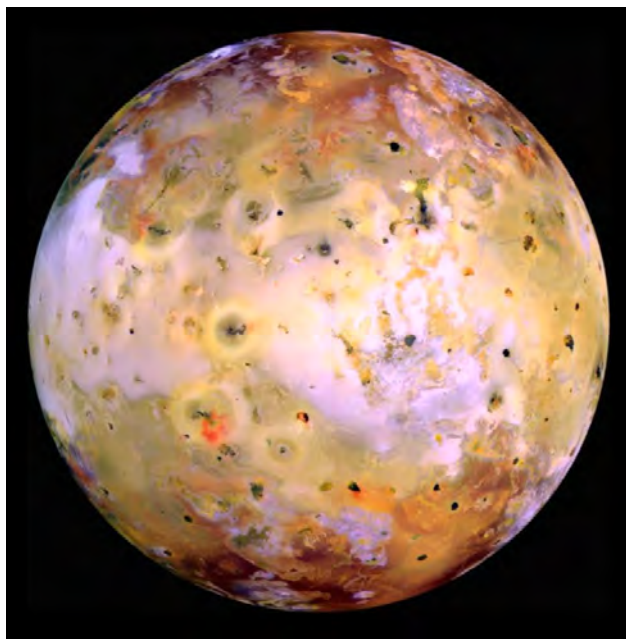


If we go a little closer to Jupiter we can see tiny little Io hovering like a jewel up above the cloud tops. When the Voyager spacecraft flew past Jupiter in 1979, it was predicted that there would be volcanic eruptions occurring on the surface. This is based on the fact that Io orbits so close to Jupiter — sometimes it's close and sometimes it's



farther away. These tidal forces acting on Io's interior should cause melting and, sure enough, a massive volcanic eruption was seen by the Voyager spacecraft, happening out against the edge of Io. You can see the center of this volcano, which is called Pele. A lot of dark material is coming out at the center. Basalt and pyroclastic materials are also ejected out of this volcano along with dust, sulfur, and sulfur dioxide gases, and these rise up to three hundred miles above the surface and create a giant

umbrella deposit that extends about eight hundred miles from the center of that eruption. These are massive eruptions, and hundreds of them are going on, dozens this size at any one time, and additional smaller trickles of lava coming out all across the body. This volcano, Pele, was named after the Hawaiian goddess of volcanoes.



Looking at Io, we can see it is completely covered in volcanoes and volcanic products. All the yellow you see is sulfur from these eruptions; the red is molten sulfur that is currently being ejected from the volcano. All the dark spots are lava flows. This is an active paradise for volcanologists. We think it's a good analog for the early Earth. There's so much internal heat in Io that it's generating melt, and we think there may be a magma ocean down beneath the surface, much like we had on the surface of the Earth in its

early days. There was so much internal heat in the Earth at the time of its formation that there was an ocean of magma on the surface.

I had a chance to work on the Galileo Spacecraft as a graduate student. This spacecraft was making flybys of Io in the late stages of the mission — we didn't want to fly too close to Jupiter itself because of the strong magnetic field and all the charged particles moving along field lines. Those charged particles wreak havoc

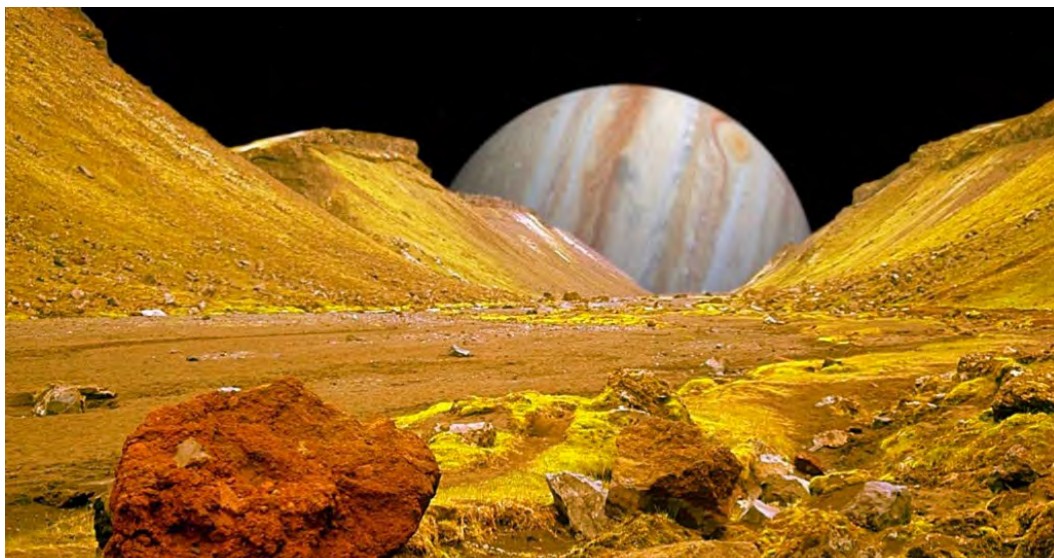


on the spacecraft and its instruments. Whenever the poor spacecraft flies close to Jupiter, Io, and Europa, it is bombarded by these particles. However, it was well worth it to get close enough to Io to see what was going on. With every flyby there was a chance the spacecraft would be bombarded so intensely by particles that it would go into safe mode. In that case, everything shuts down. The spacecraft turns toward Earth and asks “What do I do?” We try to restart it in time to get observations, but often we miss getting the observations entirely.



I wonder how many people have fasted for spacecraft? I used to do it on a on a regular basis before every flyby — “Come on, little Galileo.” I remember one flyby in particular, I went to Hawaii for some fieldwork, and when I got off the airplane, I called my friend Moses and asked, “How did the flyby go?” He said, “It went into safe mode and we lost the whole observation.” I lay on a bench under this beautiful palm tree and cried.

The difficulties of spaceflight make us appreciate things even more. With all the new spacecraft orbiting Mars, for example, there’s a terabyte of data that comes down every day, there are images that people haven’t even looked at yet, and it’s wonderful, it’s fantastic. From Galileo, every little trickle of data was precious, and it was a new way to look at data. I think at some point we’ll figure out a way to put a spacecraft (not a person) on the surface of Io, right in the middle of a volcano. When that happens, we will be able to look back at Jupiter in breathtaking perspectives like the one simulated here.





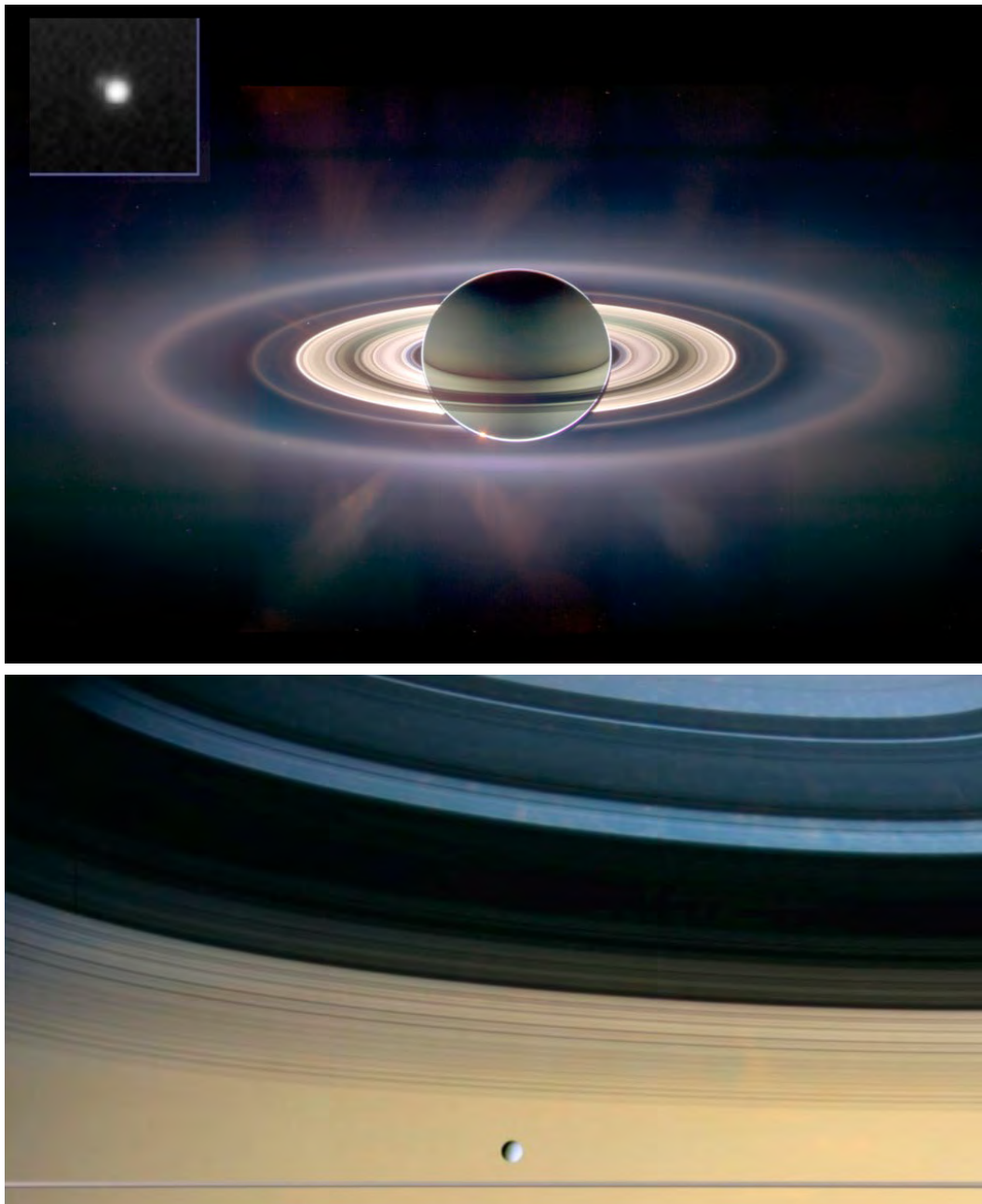
Let's go a little farther out in the solar system to Saturn — ten times farther from the Sun than the Earth. How many of you remember the first time you saw Saturn through a telescope? If you haven't yet, do that right away! Do you remember? Did you look at the back of the telescope to see if the scene had been faked by a sticker? I did, because I thought there was no way that such a scene could be real. This beautiful little planet with its tenuous, thin ring system hovers in a magical way.



Lucky for us there is a spacecraft orbiting Saturn right now, the Cassini Spacecraft, which cost three billion dollars and is the last planned NASA flagship missions. Space scientists would like to see other spacecraft like this one built, but the current financial climate has brought the effort to a standstill. Cassini is orbiting Saturn until 2017, studying its rings and its collection of moons.

One of my favorite photographs is shown on the next page. It could be taken only from a spacecraft. Can you imagine why? Because the sun is behind Saturn, we have to be on the far side of Saturn to take this picture. It has been enhanced, as you can tell, so we can see things like the atmosphere and the rings. Focus especially on that hazy, outermost "E-ring" — I'll come back to that later.

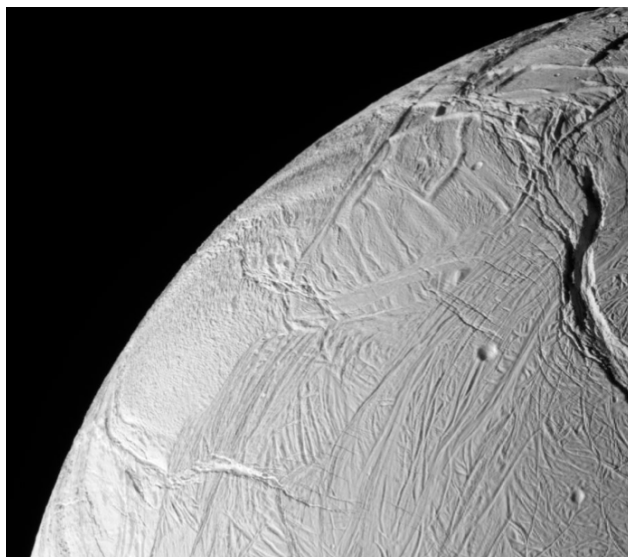
If you look very closely at this spot, you see a tiny dot in the upper left corner of the first, most detached ring. If we were to zoom in, we would see the Earth and the Moon as we look back toward the inner solar system. At this distance, our planet looks tiny. This is a point that I hope is sinking in as you've been listening to the talks today: The distances and times that we're working with are so enormous that it's difficult to comprehend — even for our own solar system — how far away these objects are. It takes a long time to get to these places.



As we zoom into Saturn, we begin to see details of its atmosphere and rings. I love the picture above because it gives a good indication of what the ring plane is like — a very thin line parallel to the bottom of the image. This is the ring plane, and the dark, ring-like features you see at the top of the image are the shadows that the rings cast upon the surface of Saturn. The rings are only about one kilometer (half a mile) thick but hundreds of thousands of kilometers across. They are made of big ice chunks that range from particle-size up to house-size.

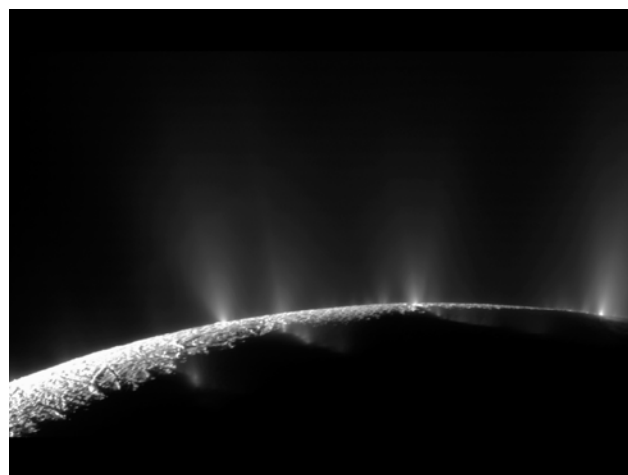
In this image, we can also see a beautiful, tiny moon hovering above the rings. This is Enceladus, 500 kilometers across, about the size of Great Britain. By all accounts it should be cold and dead. It's very small and should have lost its heat



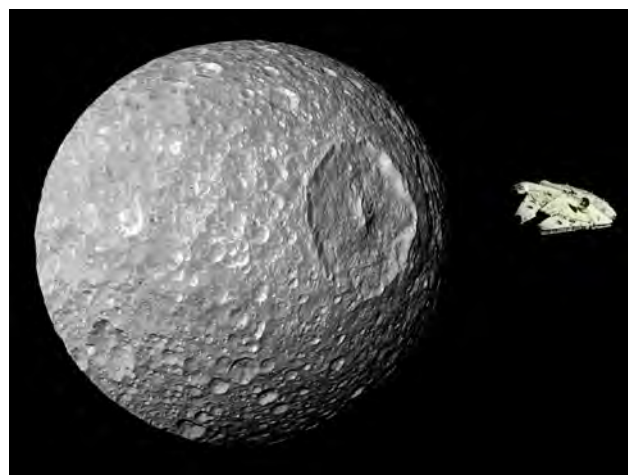


early in its lifetime. But when we got a close glimpse of Enceladus through the Cassini spacecraft, we saw a much more complex system.

We wonder: Where are the craters? Enceladus has a young surface. It has been heavily tectonized. It has been stretched apart. It has been shoved back together. And the greatest surprise of all is that there are geysers of water gushing out at the south pole!



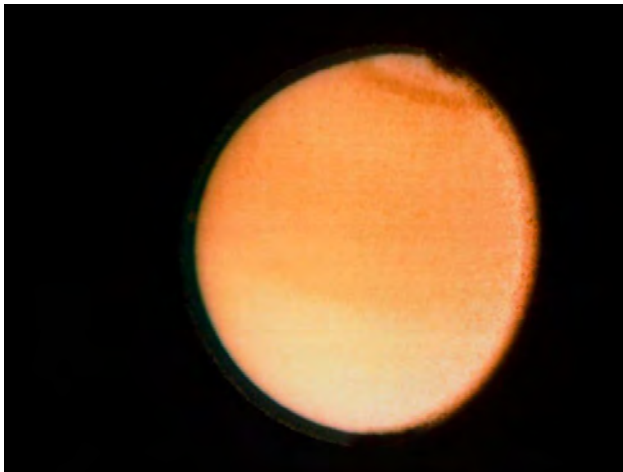
Those geysers contain methane, ammonia, carbon dioxide, and salts — everything that we'd expect a reservoir of water sitting inside the planet to contain. Here again, we encounter a body that has an energy source, liquid water, and organics. Those are the ingredients for life as we understand it on Earth, so this tiny, unlikely body is suddenly a good place for us to go and look for evidence of life. These geysers are the source of that large, diffuse E-ring you saw around Saturn. That's water being ejected out of the bottom of Enceladus right now.



Here's a sort of companion moon that resembles Enceladus, except that it is cold and dead. Does this remind you of anything? We call it the "Death Star" moon, also known as Mimas.

The crown jewel of the Saturn system — and in many ways the reason for the entire Cassini mission — is Titan. This is the largest moon of Saturn. It is larger than Mercury, and one thing we knew from looking through telescopes at Titan is that

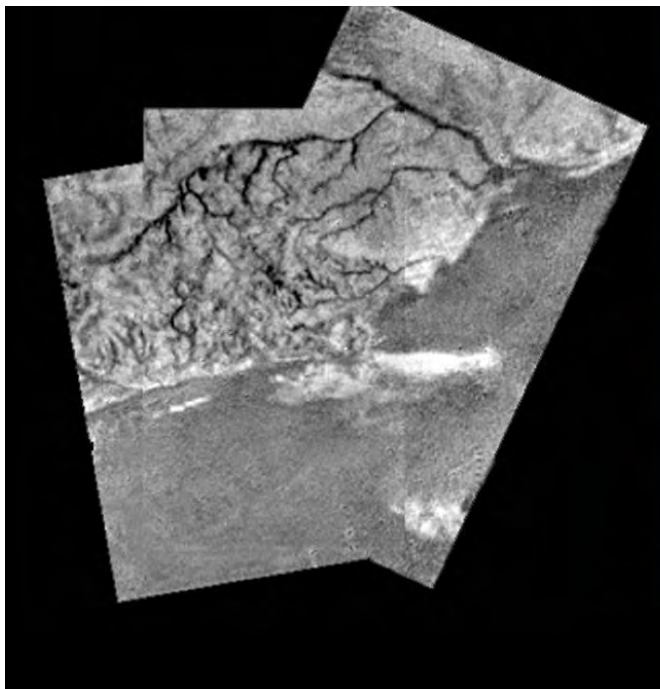


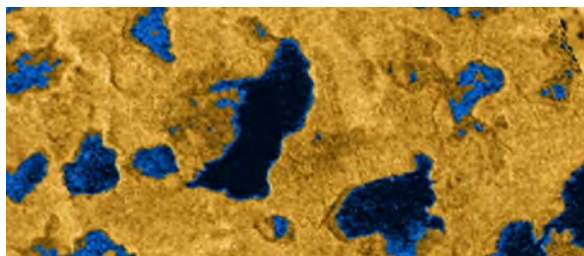


its atmosphere is made mostly of nitrogen, like the Earth's. In addition, it actually has the same atmospheric pressure as the Earth at its surface. But instead of containing water that forms clouds and rain, at Titan's location, ten times farther from the Sun than Earth, at a cold only ninety degrees above absolute zero, the liquid in the atmosphere and on the surface is methane. So we think there are methane clouds and methane rains on Titan's surface.



There was a probe specifically designed to go down through Titan's atmosphere and splash down into lakes and seas of methane or land on dry ground. As it was descending, we saw huge river channels, very well developed.





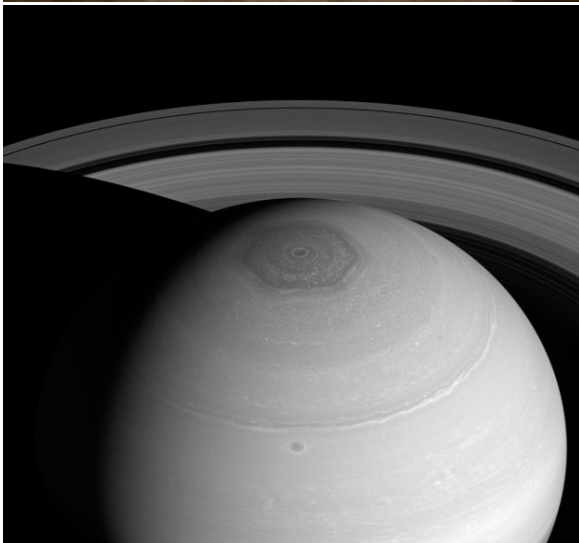
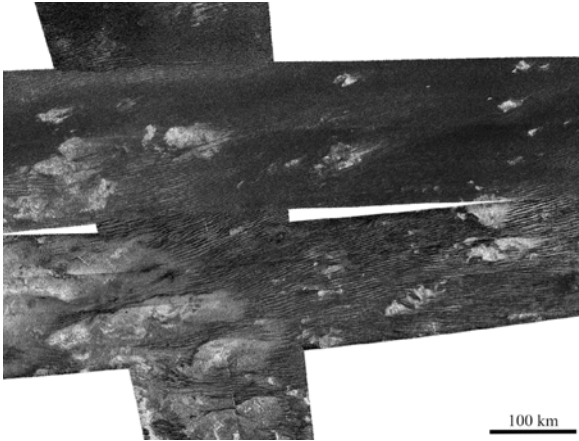
These channels are better developed than any river channels you see on Mars. The probe landed in what looks like a dried-up riverbed. It landed in the deserts. What we understand about these deserts is that they may once have

contained ephemeral flows of liquid methane, but in this location it was dry when Huygens landed. We can only see rounded cobbles of water ice from the erosion of a crust of water ice, like we see on the Galilean satellites. As the spacecraft sat on the surface, it was a bit warm. It baked off a quantity of methane that vaporized into the local atmosphere.

Titan has turned out to be a very interesting place to study. It turns our thoughts back toward home because the landscape there is very much like Earth's. There are rivers and lakes and seas of methane; there are eroded mountain belts. These lakes and seas are full. Titan is the only other body in the solar system that has lakes and seas filled with liquid.



There are not only liquid seas on Titan but also seas of sand. No one expected this. These dunes are like those found in the northern Sahara and Saudi Arabia and Namibia, but the sand grains are made of organics. Methane high in the atmosphere is broken down by photo-dissociation from sunlight, and it recombines into long-chain organics. Ethane, propane, benzene, acetylene, and other long chain organic molecules clump together, sink down to the surface, solidify into layers, and erode



from cobble-sized down to sand-sized particles that get blown into sand dunes. So now there are lots of organics on the surface of Titan, in the organic sand particles as well as in the vast seas of methane and ethane.

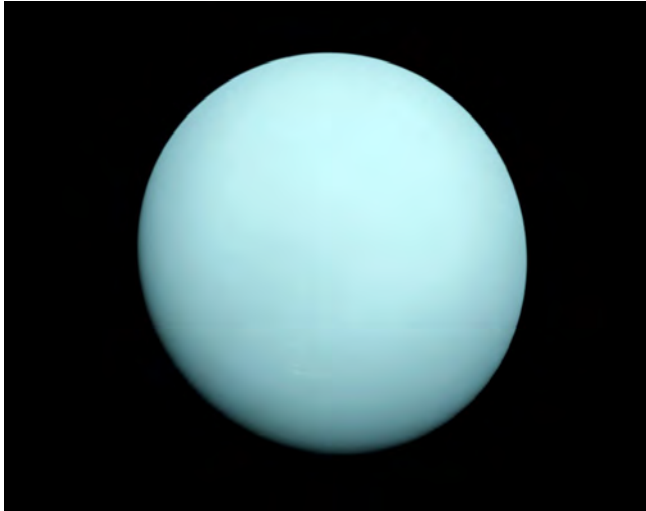
Current thinking favors the presence of a liquid water ocean underneath an icy crust and an energy source that sometimes brings this liquid up in the form of volcanoes — “cryovolcanoes,” we call them. Thus Titan is a great place look for astrobiology. Things happen at a very slow pace on Titan, but, to put things in perspective, if you lived there and looked down at Earth you would probably conclude that life on Earth is impossible because everything happens too fast. Titanians would think, “Earth has a ‘magma ocean’ on the surface” — which is our own liquid water ocean. “There’s no way they could have life.”

So we have to keep in mind that everything is relative. We have to keep our minds open to the possibility of unusual happenings.

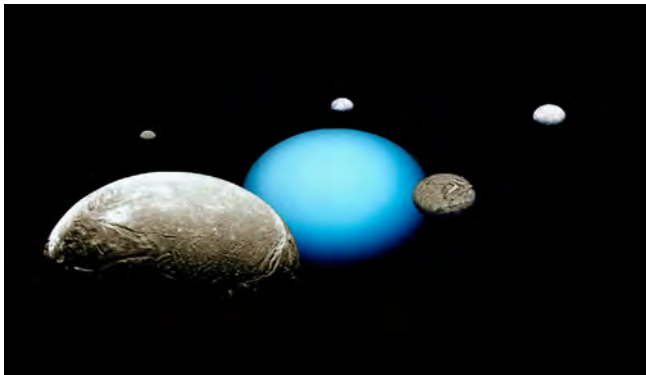
Let’s leave the sand dunes of Titan in our drone and take one last look at Saturn before we fly farther out to Uranus.

There’s a very interesting hexagonal feature at Saturn’s north pole. It’s a very regular, beautiful shape. How did it get there? Because we don’t expect such regular shape to be formed in nature, these kinds of features are often attributed to deliberate design by something

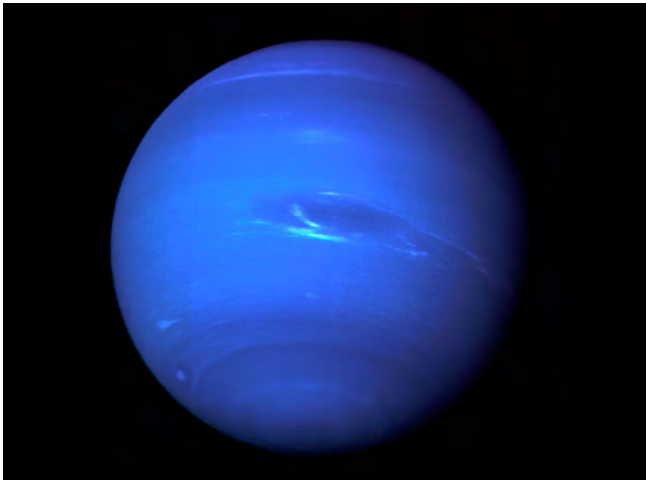




intelligent. I heard about some experiments where the scientists took a pan of water and spun it, then applied energy at a certain frequency. And once it hit a resonant frequency with the spin, the water made a small hexagon. So there could be a natural explanation for the hexagon as a sort of a resonance feature within the atmosphere. In any case, it is really beautiful.



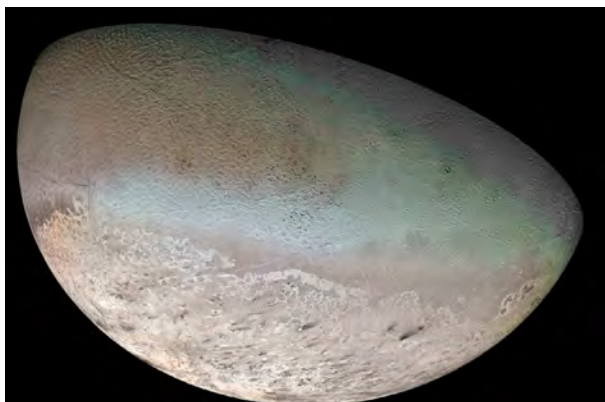
Now look how beautiful Uranus is, hovering in the sky. Uranus is so beautiful because it's smooth in texture — something no one expected. The blue color is from methane in its atmosphere.



Uranus was discovered in the late 1700s in England by William Herschel and his sister Caroline. They did a lot of work in astronomy. At that time, we had come out of the cold age of the scientific revolution, and we were entering the Age of Scientific Wonder as we began to expand our gaze outward from the orbit of Saturn. At this point, most people thought the universe — not just the solar system — ended at Saturn. Instead, the Herschels found

a planet beyond Saturn, twice as far as the distance from Saturn to the sun. That got people thinking that the universe actually might extend farther than that. So, beginning in the late 1700s, there was a gradual opening of up people's minds that was summed up well by Humphrey Davy (1810): "Nothing is so fatal to the progress of the human mind as to suppose our views of science are ultimate; that there are no mysteries left in nature; that our triumphs are complete; and that there are no new worlds to conquer."

In a similar way, new details about bodies in the outer solar system we've discussed in this chapter have helped open our minds to the possibilities of other worlds with life in our galaxy and in the universe. If you've been watching the news, you notice that all of a sudden we're finding all these very exciting and unique bodies out in the universe, especially in our own galaxy, bodies that are unique in their own way.



Some of them are so close to their suns that they are likely to be completely molten on one side and frozen solid on the other. But, in addition, there are many others that seem to have the potential for life. Recently, the National Academy of Sciences came out with a report that suggested that there might be as many as nine billion habitable planets in our

own galaxy alone. Another way of saying this is that there are more habitable planets in our galaxy than there are people on Earth. (Of course, this doesn't mean they're actually inhabited, only that they're habitable.)

As Latter-day Saints, this should not surprise us too much. We should be able to look at these big numbers and say, "Well, we should have seen this coming because God already told us there were inhabited worlds without number" (see D&C 76:24; Moses 1:33).

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# FROM ALL ETERNITY TO ALL ETERNITY: DEEP TIME AND THE GOSPEL

Bart J. Kowallis

*Now for this cause I know that man is nothing, which thing I never had supposed.*<sup>1</sup>

Like Moses, I often feel my own nothingness when compared to the greatness of God and His creations. In his face-to-face encounter with God, Moses was told that “worlds without number have I created”<sup>2</sup> and that “there are many worlds that have passed away ... and many that now stand, and innumerable are they unto man.”<sup>3</sup> Not only were the worlds that God created innumerable but the heavens as well.<sup>4</sup> With this revealed understanding of the enormity of God’s creations, I am never troubled by the idea of deep time.<sup>5</sup>

Deep time is also called “geologic time” and refers to the vast length of time scientists have determined it took for the earth and the heavens to arrive at their current form and station. Imagine with me for a moment a movie with perhaps a catchy title like “Earth: The Movie” and that this movie shows the entire history of the earth from its creation to the present day. The producers have reduced each year of earth history down to one second of movie time. So, being an interested student of natural history, you grab a jumbo popcorn and a caffeine-free diet Coke and join a throng of others for the opening night release of the movie. After watching for the first couple of hours, you begin to wonder how much longer this movie is going to last, and in spite of the severe social consequences, you pull out your phone and make a quick calculation. Hmm — 60 seconds in a minute, 60 minutes in an hour, 24 hours in a day, and 365.25 days in a year gives you 31,557, 600 seconds in a year. So that means if the producers reduced earth’s history to one second for each year, and the earth is 4.6 billion years old, then this movie is going to be playing for



*Carina Nebula As Seen from the Hubble Space Telescope, 2010*

about 146 years! At that point you decide you'd better get up and get a refill on your popcorn and soda.

So how do we reconcile such long periods with our religion? In both science and religion we rely on faith in our beliefs to guide us and help us interpret the world. In our LDS faith, the Prophet Joseph Smith laid down the thirteen articles of faith<sup>6</sup> that succinctly provide us with a snapshot look at our foundational beliefs. I like to summarize in a similar way the basic faith and beliefs of scientists in what I call the scientist's articles of confession and belief. These are:

**1. We confess that nothing in science is ever absolutely proved.** Absolute proof requires us to have no room for error, no approximations, no tests left undone, no possibility of future modification. Science never reaches this point, no matter what the principle happens to be. Neither gravity nor motion nor relativity nor deep geologic time has been proven in an absolute sense. But simply because they have not reached the level of absolute proof does not mean that they are not useful. As far as we have been able to determine, they are true.

**2. We confess that all scientific laws and theories are based upon assumptions and approximations.** Even though our scientific laws and theories are based upon assumptions and approximations, we use them because they work. Newton's laws of motion and gravity are approximations that work well enough for us to plan,

plot, and send rockets to the Moon, to Mars, and to the farthest corners of our Solar System. An exact answer in most scientific problems is unattainable, but our approximate answers can still get us close enough to the exact answer to be very useful.

**3. We confess that science cannot answer the ultimate question of “why?”** For example, why do two objects attract one another? We might answer that they attract because of gravity. But why is there gravity? We might respond that there is gravity because the objects have mass and that masses create a kind of depression in the fabric of space and time into which nearby objects will fall. But why? Why do objects with mass affect space and time in this manner? We don’t know. They just do. The beautiful thing in science is that no matter how many questions we answer, there are always more that are unanswered for us to investigate.

**4. We claim that the first principles and assumptions of science are: first, faith in the existence of the physical universe; second, requisite causes for all events; third, between two contrary positions, only one can be true; and fourth, laws of nature apply equally to all people and objects.**

These are some of the basic assumptions of science, none of which we can prove, but which appear to be true based upon numerous observations and tests. Here are a few more of our fundamental assumptions.

**5. We believe that the same principles of science apply in all directions and all places, whether we are located high or low, far or near, east or west, in Provo or Salt Lake City.**

**6. We believe that all men will find the principles of science to be the same whether they be at rest or in motion; indeed we claim that motion itself can only be measured in a relative sense; that is to say, there is no absolute motion.**

**7. We believe that the principles of science are the same today, yesterday, and forever, that they are unaffected by the passage of time.**

I will stop there. That is not quite as many articles as the Prophet Joseph laid out for our faith, and more could probably be added to this list. However, these will suffice for our discussion here, where I will focus my remarks primarily upon the last one: our belief that the principles of science are the same today, yesterday, and forever. In my field of geology, this idea has been called “uniformitarianism,”<sup>7</sup> a somewhat unfortunate term that sounds a bit like a religious sect. Physicists call the idea “time symmetry.”



### Time Symmetry and the Age of the Earth

In geology, the idea that time was long and deep originated with James Hutton, a Scottish gentleman-farmer, who was one of the first to see the earth and its processes through the lens of time. In 1788, his *Theory of the Earth* was published by the Royal Society of Edinburgh.<sup>8</sup> This paper included two key ideas that continue to shape the way scientists think about time and about the earth. First, Hutton stated, “In examining things present, we have data from which to reason with regard to what has been; and, from what has actually been, we have data for concluding with regard to that which is to happen hereafter. Therefore, upon the supposition that the operations of nature are equable and steady, we find, in natural appearances, means for concluding a certain portion of time to have necessarily elapsed, in the production of those events of which we see the effects.”<sup>9</sup>

In summary Hutton was proposing that the processes and systems which operate on the earth today also operated in the past and that as we try to interpret the history locked up in earth’s rocks, we should use modern processes and systems to guide our interpretations and to understand the time required to accomplish the tasks. The idea was popularized by the phrase: “The present is the key to the past.”<sup>10</sup>

Hutton’s second landmark contribution was the idea that the history of the earth was endless. He proposed that, “Time, which measures every thing in our idea, and is often deficient to our schemes, is to nature *endless* and as nothing; it cannot limit that by which alone it had existence; and as the natural course of time, which to us seems *infinite*, cannot be bounded by any operation that may have an end, the progress of things upon this globe, that is, the course of nature, cannot be limited by time, which must proceed in a continual succession.”<sup>11</sup> Hutton’s paper ended by reaffirming this belief in the unlimited nature of time, stating that, “The result, therefore, of our present enquiry is, that we find no vestige of a beginning — no prospect of an end.”<sup>12</sup>

In the late 1700s Hutton’s ideas were not well received by the religious community. In their book *The Discovery of Time*, Tolmin and Goodfield proposed that the “bitterness and virulence aroused” by Hutton’s ideas were related to the aftermath of the French Revolution when the “impiety and free thought common among French intellectuals” before the revolution had been met with terror and brutality by the revolutionaries.<sup>13</sup> In Great Britain, Hutton was criticized by chemist and naturalist Richard Kirwan, president of the Royal Irish Academy. Kirwan defended a strict interpretation of the Bible and applied this interpretation to earth events.<sup>14</sup> Interestingly, Kirwan’s classical view of God as “from all eternity ... to all eternity” with no beginning and no end<sup>15</sup> resonates with Hutton’s “no vestige of a beginning, no prospect of an end.” But that was as far as their agreement would go. Kirwan, obviously referring to Hutton’s ideas, said, “The existence of the world, say [the scholastics], is eternally possible; ... their inference, that the [creation], resulting from an eternally omnipotent cause, could also be eternal is inadmissible, as causation essentially requires priority of existence.” The physical creation, Kirwan



*James Hutton, 1726 - 1797. Geologist, 1776, Henry Raeburn (1756–1823)*

goes on to say, “implies, at least, an instant, in which the created ... did not exist: otherwise existence could not have been bestowed upon it.”<sup>16</sup>

Today, we would agree with Kirwan and not Hutton on the idea that the earth has no “vestige of a beginning nor prospect of an end,” for it appears that the earth definitely had a beginning, but we would side with Hutton in his idea of using the physical laws and processes that are observed operating on the earth today as the means to understand the past and that, by using those physical laws and processes, the age of the earth appears to be incredibly old.

### **Determination of the Earth’s Age**

Over the years since Hutton’s time, scientists have tried a number of methods to determine the age of the earth. One of the earliest attempts to arrive at a non-biblical age for the earth actually came a decade before Hutton. It was made by French naturalist Georges-Louis Leclerc, also known as le Comte de Buffon in 1779.<sup>17</sup> Buffon reasoned that the earth had cooled from an initial hot sphere, and using experiments on a small sphere of hot iron, he determined that it would have taken about 75,000 years for the earth to reach its present state and temperature.

Using similar reasoning but starting with a molten earth, Lord Kelvin (at the time still called William Thompson) in 1862 determined an age of 20 to 400 million years for the earth to cool to its present state.<sup>18</sup> He later refined his estimate to somewhere between 20 and 40 million years. Although this estimate was quite a

bit older than what Buffon had determined, it was much too young for Hutton's followers.

Another early attempt at determining the earth's age was made by John Joly and published in 1899, using the idea that salt accumulated at a constant rate over time into the oceans.<sup>19</sup> Joly was an Irish geologist, mineralogist, and inventor who is best known for his pioneering efforts at treating cancer with radiation.<sup>20</sup> Actually it was Edmund Halley, most famous for his astronomy studies, who proposed, even before Hutton's time, that the age of the ocean might be determined by its saltiness.<sup>21</sup> But Halley never made the actual calculation of the earth's age using this method. Joly did. Joly arrived at an age of 100 million years, substantially older than the 20-40 million proposed by Lord Kelvin, but still too young for many geologists, biologists, and other naturalists.<sup>22</sup> The problem with Joly's calculations was that they did not take into account the removal of salt from the ocean to form thick layers of salt that have been documented in many places in the geologic record.<sup>23</sup>

Radioactivity, discovered and studied in the late 1800s and early 1900s by Henri Becquerel, Marie and Pierre Curie, Ernest Rutherford, and Frederick Soddy, was recognized early by some scientists as an internal source of heat that would keep the earth from cooling at the rate determined by Lord Kelvin.<sup>24</sup> By 1907, American chemist Bertram Boltwood, in a series of papers published in prestigious journals, outlined the use of radioactivity in determining the ages of rocks and minerals as uranium decayed through several steps to form lead.<sup>25</sup> He found ages as old as 2.2 billion years for some samples. At the time the work was oddly "met with indifference," and most geologists discounted the effect of radioactivity on the earth's age and temperature.<sup>26</sup> Englishman Arthur Holmes, however, championed the idea and was for the next two decades almost the only scientist who persevered in studying the use of radioactivity as a dating technique.<sup>27</sup> The evidence accumulated by Holmes and a few others eventually became too much for the scientific community to ignore, and the use of radioactive decay to determine the ages of earth events became the common practice.

### **Myths about Earth's Age and Creation**

So how have these ideas about time and creation been received by LDS Church leaders? To examine this history, I would like to discuss ideas about time by looking at what I call the "Myths about science."

*Myth #1: Scientific Theories are Just Speculation; Since They Are Not Facts, I Don't Need to Believe or Worry About Them*

Every myth usually has some truth mixed with varying amounts of fantasy. This myth, which I find very prevalent among my students and the general public, has this grain of truth: no one has to believe anything he or she does not want to believe. But those who choose not to believe the theories of science should at least understand what is meant by theory. In science a theory is quite different from a

hypothesis. A hypothesis is an idea, a question, a speculation, or a possibility, with very little data to back it up. Hypotheses give direction to our research and help us continue to expand the frontiers of knowledge by providing us with challenges and questions to answer. My impression is that most nonscientists do not distinguish between a hypothesis and a theory.

A theory is quite different. A theory is not just speculation, even though the word is often used in conversation in this manner. Someone might say, “I have a theory that the football team would play better if they just drank more pickle juice.” Among scientists this would be a hypothesis, not a theory. To make it into a theory, data would need to be collected in very carefully constructed tests. This data would then be examined and analyzed to look for patterns and trends. The tests would then need to be duplicated by other scientists working with other football teams, and eventually a soundly reasoned explanation, based on all the available evidence and data, would be constructed. This would then become a model or theory and might be given a name like “The Pickle Juice Theory” or something equally catchy.



*Rewriting the Law of Gravity, 2012, John Cole*

Scientific laws are no different; they are really just impressive theories. The Law of Gravity, for example, is an explanation for why objects are attracted to each other. It could just as easily be called the Theory of Gravity. You do not have to believe in the Theory of Gravity, and indeed there are still scientists who are questioning this theory and suggesting that perhaps it needs to be modified.<sup>28</sup> However, I would recommend it to you as a

very good explanation for many physical phenomena — an explanation that you probably do not want to ignore if you plan to have an active life.

So, when scientists say “theory,” they mean a well reasoned explanation that satisfies all or most of the available data and has been demonstrated to work. That is why we use them. They work. Does this mean our theories or laws will never be modified or changed? Certainly not. Anytime new, reliable, reproducible data or observations appear that do not fit the explanations, the theories must be looked at again and modified. In the end we keep the explanations that work and discard those that do not.

In our context here, the theories that explain radioactive decay and the use of radioactive elements as clocks are some of the most widely tested and tried explanations in science. They have been demonstrated to work in many places and under many different conditions.<sup>29</sup> Do you have to believe them? No. Just as I said

earlier with the theory of gravity, you are free to believe whatever you want, but you should understand that by rejecting the theory you are rejecting something that has been demonstrated to work based on years of scientific data and careful scientific review. In the context of the LDS Church, I personally do not believe there is any conflict between the theories of radioactive decay and gospel doctrine. There is, however, in some quarters, the perception that an old earth would violate church doctrine. This is the next myth I wish to discuss.

*Myth #2: Official LDS Church Doctrine Is That the Earth Is Only a Few Thousand Years Old*

I have not found any official statement by the First Presidency on the age of the earth. However, many individuals, including a number of LDS scientists and writers as well as several General Authorities, have made statements about its age. This is indeed a case of where, if you want to rely on someone else's answer, you can pick your favorite, because the statements of LDS authorities and scientists vary widely. I will briefly outline here a few of the writings and statements made on this issue.

**Statements That Are Supportive of or Neutral about an Old Earth**

In January 1844, at the time Joseph Smith was prophet, a letter from W.W. Phelps to William Smith was published in the *Times and Seasons* that included the interesting statement:

Eternity ... has been going on in this system, (not this world) almost two thousand five hundred and fifty five millions of years: and to know at the same time, that deists, geologists and others are trying to prove that matter must have existed hundreds of thousands of years.<sup>30</sup>

Phelps apparently arrived at this number by equating the 7 days of creation to 7,000 years on Kolob and calculating that one Kolob year of 365 days was equivalent to 365,000 earth years, giving a total of 2.555 billion years.<sup>31</sup> Apart from the somewhat unusual idea of trying to put an age on eternity, this passage suggests that the idea of an old creation (of at least 2.555 billion years) for our "system," as Phelps called it, was not foreign to the early members of the Church.

The Prophet Brigham Young, in a discourse delivered in the Tabernacle in Salt Lake City on May 14, 1871, stated:

We differ very much with Christendom in regard to the sciences of religion. Our religion embraces all truth and every fact in existence no matter whether in heaven, earth, or hell. ... The Lord is one of the most scientific men that ever lived; you have no idea of the knowledge that he has with regard to the sciences.<sup>32</sup>

In this same address President Young said:

Our religion will not clash with or contradict the facts of science in any particular. You may take geology, for instance, and it is a true science; not that I would say

for a moment that all the conclusions and deductions of its professors are true, but its leading principles are; they are facts — they are eternal. ... As for the Bible account of creation we may say that the Lord gave it to Moses, or rather Moses obtained the history and traditions of the fathers, and from these picked out what he considered necessary, and that account has been handed down from age to age, and we have got it, no matter whether it is correct or not, and whether the Lord found the earth empty and void, whether he made it out of nothing or out of the rude elements; or whether he made it in six days or in as many millions of years, is and will remain a matter of speculation in the minds of men unless he give revelation on the subject.<sup>33</sup>

In a later discourse given on September 17, 1876, President Young stated:

It is said in this book [the Bible] that God made the earth in six days. This is a mere term, but it matters not whether it took six days, six months, six years, or six thousand years. The creation occupied certain periods of time. We are not authorized to say what the duration of these days was.<sup>34</sup>

I do not propose that President Young was advocating here for an old earth of millions of years in age but that he was suggesting that it did not matter and that he was supportive of science in general.

B. H. Roberts, member and president of the First Council of Seventy, wrote on many topics including the age of the earth. He wrote in 1924 that:

While the Bible may teach that it was only about six thousand years since man was placed upon the earth, how long it required to prepare this planet with all its wealth of fruits and vegetables and animal life, for the abode of man, is not known.<sup>35</sup>

Roberts added that the days of creation were not twenty-four-hour days, but “great periods of time.”<sup>36</sup>

On 9 August 1931, Apostle and former professor of geology James E. Talmage delivered an address in the Tabernacle entitled, “The Earth and Man.” The talk was later printed in full in the *Deseret News*.<sup>37</sup> Talmage’s oft-quoted statement that, “The opening chapters of Genesis and scriptures related thereto were never intended as a textbook of geology, archaeology, earth-science, [or man-science] ... We do not show reverence for the scriptures when we misapply them through faulty interpretation,”<sup>38</sup> is similar to Galileo’s statement in 1613 in his *Letter to Castelli*: “Scripture deals with natural matters in such a cursory and allusive way that it looks as though it wanted to remind us that its business is not about them but about the soul ...”<sup>39</sup>

President David O. McKay, in a speech given at BYU in October 1956 while he was President of the Church, said:

And now I have just time to comment of the opportunity of the BYU to teach these fundamental truths. ... Whatever the subject may be, the principles of the gospel of Jesus Christ may be elaborated upon without fear of anyone’s objecting,





*Artist's Conception of Planets Over the Nebulae in Space*

and the teacher can be free to express his honest conviction regarding it, whether that subject be in geology, the history of the world, the millions of years that it took to prepare the physical world, whether it be in engineering, literature, art — any principle of the gospel may be briefly or extensively touched upon for the anchoring of the student who is seeking to know the truth.<sup>40</sup>

I do not think that this statement necessarily shows President McKay's personal views on the age of the earth, but it demonstrates that, at least in his mind, there was no issue with those who held that belief.

Apostle John A. Widstoe wrote in his book *Evidences and Reconciliations* in 1960 that the:

word translated day in Genesis really means, in the original, "an age or undefined period of time," and concluded his chapter on the age of the earth by stating that, "Every person must decide for himself, on the basis of the evidence produced, which of these three opinions as to the age of the earth, before Adam, seems most reasonable to him, whether (1) six days, or (2) six thousand years, or (3) many millions of years. Clearly it does not matter to one's daily welfare or ultimate salvation which view he adopts, except that every Latter-day Saint must seek and cherish truth above all else."<sup>41</sup>

Dr. William Lee Stokes, professor of geology at the University of Utah and a faithful member of the LDS Church, wrote in his 1979 book *The Creation Scriptures*:

Common sense and a minimum of research should convince anyone ... that God's Days and Nights cannot be the days and nights of human experience. The scriptural account is clear on this point. There could be no ordinary astronomical day-night relationships without a light-giving sun and no sun is mentioned until

the fourth day of creation. It seems to have been the intent of God to commence the designation of creative days even while the earth was without form, certainly before the “firmament” of heaven was created.<sup>42</sup>

As an Apostle, Elder Bruce R. McConkie, in somewhat of a reversal of his earlier views, wrote in June 1982:

“In six days the Lord made heaven and earth, the sea, and all that in them is, and rested the seventh day” (Exodus 20:11). . . . But first, what is a day? It is a specified time period; it is an age, an eon, a division of eternity; it is the time between two identifiable events. And each day, of whatever length, has the duration needed for its purposes.<sup>43</sup>

Dr. Henry Eyring, father of President Henry B. Eyring, wrote in his 1983 book *Reflections of a Scientist*:

In my judgment, anyone who denies the orderly deposition of sediments with their built-in radioactive clocks places himself in a scientifically untenable position. . . . I am completely content that there is room in the Church for people who think that the periods of creation were twenty-four hours, one thousand years, or millions of years. I think it is fine to discuss these questions and for each individual to try to convert others to what he thinks is right. It is only fair to warn parents and teachers that a young person is going to face a very substantial body of scientific evidence supporting the earth’s age as millions of years and that a young person might ‘throw the baby out with the bath’ unless allowed to seek the truth, from whatever source, without prejudice.<sup>44</sup>

Dr. Sterling B. Talmage, son of Apostle James E. Talmage and a professor of geology, wrote in his 2001 book, *Can Science Be Faith Promoting?* that, “As one who believes in God ‘from all eternity to all eternity,’ I object to any attempt to wrest the scriptures so as to crowd all of his terrestrial activities into a week.”<sup>45</sup>

### **Statements That Are Opposed to an Old Age for the Earth**

In 1878 Apostle Orson Pratt said:

Geologists may study, year after year, all the best works they can obtain, concerning the geological phenomena of our globe; they may speculate and say, the earth is several millions of years old, founding their speculations upon geological appearances; they may say, that it must have passed through successive changes for millions of years. But after all, what do they really know?<sup>46</sup>

In 1954, then Apostle Joseph Fielding Smith wrote in his book *Man: His Origin and Destiny* that the scriptures were clear that the days of creation were celestial days of one thousand years and that the earth is now passing through another celestial week of its mortal existence.<sup>47</sup> He cites scripture and statements by the Prophet Joseph Smith in support of this interpretation.

Elder Bruce R. McConkie, in the 1966 version of his book, *Mormon Doctrine*, stated on the subject of the age of the earth:



Evolutionary theories assume that hundreds of millions of years were involved, first in the creation of the earth as a habitable globe, and again in the evolution of spontaneously generated, single celled forms of life into the complex and multitudinous forms of life now found on its face. We have rather specific scriptural indications that the creative period was of relatively short duration. The record says: "It was after the Lord's time, which was after the time of Kolob" (one day on which planet is equal to a thousand years of our time); "for as yet the Gods had not appointed unto Adam his reckoning" (Abraham 5:13). However, for our present purposes, it is sufficient to know that the time element since mortal life began on earth is specifically and pointedly made known. We are now nearing the end of the sixth thousand years of this earth's "continuance, or its temporal existence" (D&C 77:6), and the millennial era will commence "in the beginning of the seventh thousand years" (D&C 77:12). That is, we are approaching the end of the sixth of the periods of one thousand years each, all of which periods have occurred since the fall, since the earth became temporal, since it gained its telestial status, since it became the natural earth that we know, since death and mortality entered the scene. Thus the period during which birth, and life, and death have been occurring on this earth is less than 6,000 years.<sup>48</sup>

Dr. Melvin A. Cook and M. Garfield Cook, a father and son team of two LDS scientists who founded the IRECO Chemical Company, wrote a lengthy defense in support of a young earth in their book, *Science and Mormonism*, in 1967.<sup>49</sup> Although neither of the Cooks were trained as geologists or geochronologists, they both had degrees in science fields.<sup>50</sup>

Certainly we can see that among faithful LDS scientists and Church leaders there is ample room for differences of opinion on the subject of earth's age. My personal views are that the earth is very old, and I see no reason why that view is in any way at odds with my firm belief in God, His creation, and the doctrines of the gospel.<sup>51</sup>

### *Myth #3: The Earth Is Old Because It Was Made From Pieces of Older Planets*

In 1841 William Clayton, the Prophet Joseph Smith's private secretary, reported that the prophet said: "This earth was organized or formed out of other planets which were broke up and remodeled and made into the one on which we live."<sup>52</sup> Later, the Prophet Joseph in the King Follett discourse stated that, "the word create ... does not mean to create out of nothing; it means to organize; the same as a man would organize materials to build a ship."<sup>53</sup>

This was a surprising doctrine for the 1840s and counter to the prevailing view of creation among religions of the time. Even today, creation *ex nihilo* is accepted by most Christian sects.<sup>54</sup> Today, science firmly believes that the earth and indeed our whole solar system was created from the remnants left behind when an earlier star, which most likely had planets of its own, was destroyed in a supernova explosion, an explosion that allowed the formation of elements heavier than iron.<sup>55</sup> So the Prophet Joseph was not only ahead of his time theologically but scientifically as well.



*Artist's Conception of Earth with Rising Sun and Asteroid Belt*

Apostle Orson Pratt extended Joseph's idea to explain the old ages being proposed for the earth. In a discourse given in 1876 he said:

Geologists pretend to say that this earth must have existed many millions of years. ... We will go further than geologists dare to go, and say that the materials of which the earth is composed are eternal, they will never have an end. ... We are willing, for the sake of argument, to admit that the materials themselves are as old as geologists dare to say they are; but then, that does not destroy the idea of a God, that does not destroy the idea of a great Creator, who, according to certain fixed and unalterable laws, brought these materials, from time to time, into a certain organization.<sup>56</sup>

I would agree with Elder Pratt that the old ages proposed by geologists do nothing to destroy the idea of a great Creator; however, I would disagree with his explanation for these old ages. I have heard this idea used in LDS settings to explain the fossils found in earth's rocks. These ideas do not hold up under the scrutiny of a careful analysis of the available evidence. All of the evidence gathered from studying the earth indicates that its surface was molten and very hot early in its history. These conditions would have destroyed any fossils (if by some miracle they had survived the supernova that wiped out the earlier star system), and the heat and molten nature of the surface would also have reset any radioactive clocks to zero. The radioactive clocks used by scientists are more like stopwatches than clocks. They start when a rock or mineral cools to a certain temperature and can be reset to zero if they are reheated. We call the temperature at which minerals begin to accumulate "time" as their "closure temperature."

Different minerals and different radiometric methods have different closure temperatures ranging from more than 900° C. for the uranium-lead method — using the mineral zircon — to less than 100° C. for the fission-track method using the mineral apatite.<sup>57</sup> The value in minerals and systems that are sensitive to different temperatures is that we can use a variety of these methods to help us construct a

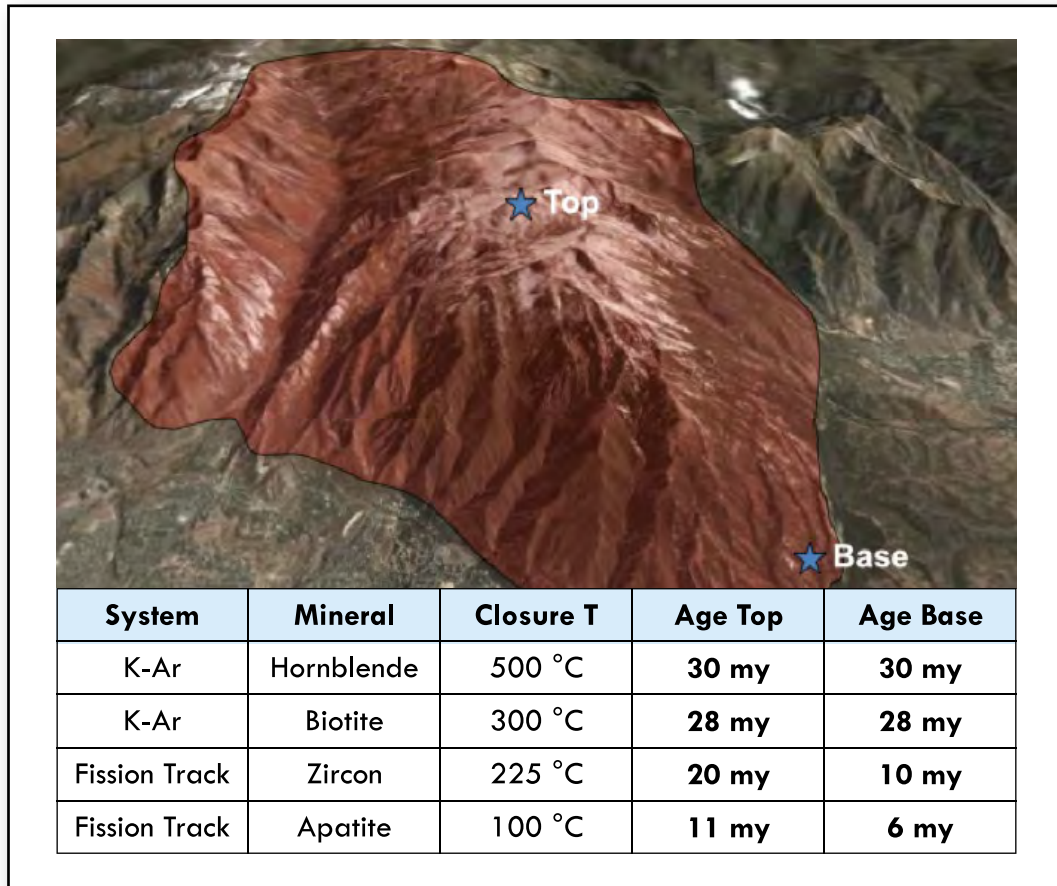
**CLOSURE TEMPERATURES FOR SOME ISOTOPIC DATING SYSTEMS**

System	Mineral	Closure T - °C
U-Pb	Zircon	>900
K-Ar	Hornblende	500
K-Ar	Biotite	300
Fission Track	Zircon	225
Fission Track	Apatite	100

thermal history of a rock, and by knowing its thermal history, we can infer the timing of different events in its past.<sup>58</sup>

Let me use as an example the Salt Lake Temple granite, called by geologists the Little Cottonwood Stock. This granite is found in the Wasatch Mountains at the south end of the Salt Lake Valley. The granite crops out along the Wasatch fault at the base of Lone Peak and continues all the way up to the top of that mountain. A few years ago, I had a couple of my students collect samples of the granite from the top to the bottom of the mountain. This granite had already been dated using the potassium-argon method and was found to be approximately 30 million years old using the mineral hornblende and 28 million years old using the mineral biotite.<sup>59</sup> These minerals have closure temperatures that are fairly high. Since granite melts at about 700° C., these ages seemed to represent times close to but somewhat after the time the granite was emplaced. We extracted two other minerals from the granite samples my students collected: apatite and zircon. These we dated using the fission-track method. The closure temperature for fission tracks is lower than for many other radiometric systems, and we hoped to be able to see how and when the granite had cooled through these lower temperatures. Our results confirmed what others had proposed about the uplift of the Wasatch Mountains along the Wasatch fault — the ages at the top of the mountain were older than those at the bottom. Using the differences in the ages determined from the top and bottom of the mountain, we were able to calculate an uplift rate and cooling history for the mountain.<sup>60</sup> The Wasatch Mountains near Salt Lake City are rising at an average rate of about 0.68 mm/year. It is this uplift that triggers occasional earthquakes along the Wasatch fault.

So when geologists “date” a rock or mineral, they are not dating the age of the elements, but they are dating thermal events. Therefore, when we find minerals that give very old ages of billions of years, we believe that these ages represent old events. The event could be anything that causes the sample to cool below its closure temperature, such as the eruption of a volcano, the uplift of a mountain, or perhaps



in the case of the oldest ages, the cooling of the earth after its formation. These ages are not the ages of the elements that make up the rocks or the mountains or the earth but rather the ages of events in the earth's history.

*Myth #4: Geologists have used carbon-14 to date the age of the earth.*

This is a fairly prevalent myth as far as I have been able to determine from my limited sampling of students over the years. I once took a survey of my introductory geology students and asked if carbon-14 had been used to determine the age of the earth, and well over 50% of the class responded in the affirmative. The truth is that carbon-14 is not useful for dating the age of most rocks and certainly not for dating the age of the earth. Carbon-14 has a half-life of about 5730 years.<sup>61</sup> Radioactive isotopes like carbon-14 can be used as clocks over a span of about 10 half lives; for carbon-14 that would be about 57,300 years. Beyond 10 half-lives there is generally not enough of the isotope left in a material to get a reasonably accurate age. So have geologists used carbon-14 to determine an age for the earth? The answer is no! This method has not been used for this purpose. However, carbon-14 has been used to determine the age of many archaeological sites and some young geological events.<sup>62</sup>

Today, methods based on the decay of uranium into lead are the foundation of most attempts to determine an age for the earth. The oldest zircons, dated using

this method on rocks found on the earth, come from Australia and have ages of 4.4 billion years.<sup>63</sup> Dating of minerals in meteorites, however, gives ages 150 million years older, or about 4.55 billion years.<sup>64</sup> We do not find rocks on earth that are as old as meteorites because it is very difficult to find anywhere on earth not thermally disturbed since its formation. So most of the events dated using earth rocks are younger than the time the planet first formed.

The use of these radiometric clocks has shown us that the earth does indeed have a beginning — a beginning that happened about 4.55 billion years ago, reaching back into time so deep that perhaps we can understand why Hutton saw “no vestige of a beginning, no prospect of an end.”

But should we worry or lose faith over an old age for the earth? I personally see no reason to do so. My sentiments on the significance of the age of the earth echo those of Dr. Henry Eyring, one of the most respected of LDS scientists. After reviewing the evidence from modern science for an old earth, he wrote in his book, *The Faith of a Scientist*:

Most scientists ... agree on an age for the earth of about four and one-half billion years. On the other hand, the exact age of the earth is apparently of so little import religiously that the scriptures sketch earth history only in the briefest terms. ... Gospel truths which influence our salvation are unaffected by considerations such as this.<sup>65</sup>

### Acknowledgments

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### Endnotes

1. Moses 1:10.
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3. Moses 1:35
4. Moses 1:38
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# THE EARTH AND MAN

James E. Talmage

**I**n the beginning God created the heaven and the earth. And the earth was without form, and void; and darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters (Genesis 1:1-2).

Any question as to when that beginning was is largely futile because [it is] unanswerable. In the first place we have no time unit by which to measure back through the ages to the time at which, so far as the earth is concerned, time began.

Years are as inadequate in any attempted survey of the stages of earth development as are miles to the astronomer who would span the distances of interstellar space. He speaks in terms of light-years, such unit being the distance traversed by a ray of light speeding on at the rate of approximately 186,000 miles per second throughout a year.

Second, we are without information as to what stage of earth development is indicated by “the beginning.” And what is a beginning in nature? At best it is but a new start in advance of what had passed up to that point of time; and every beginning is an ending of what went immediately before, even as every consummation is a commencement of something greater, higher, and therefore superior to the past.

## **The Earth Older Than Man**

To the thoughtful mind there can be no confusion of the beginning spoken of in the opening verse of Genesis with the advent of man upon the changing earth; for by the scriptural record itself we learn of stage after stage, age after age of earth processes by which eventually this planet became capable of supporting life — vegetable, animal and human in due course.

Whether or not scientists have been able to see, however dimly, the way by which the earth as an orb in space was formed matters little except as a subject of academic



*The Creation: Sun, Moon, Stars, Earth, 15th century.  
Great Malvern Priory, Window S2, Worcestershire, UK*

interest. For many years it was very generally believed that the earth, once formless and void, passed through stages of cooling of superheated gas to liquid, thence to the solid state, as the Nebular Theory assumed; but this conception has given way to the later thought that the earth as a solid spheroid has resulted from the bringing together of particles once diffused in space — this being the basis of the Planetesimal Hypothesis.

But this we know, for both revealed and discovered truth, that is to say both scripture and science, so affirm — that plant life antedated animal existence and that animals preceded man as tenants of earth.

### **Life and Death Before Man's Advent**

According to the concept of geologists, the earth passed through ages of preparation, to us unmeasured and immeasurable, during which countless generations of plants and animals existed in great variety and profusion and gave in part the very substance of their bodies to help form certain strata which are still existent as such.

The oldest, that is to say the earliest, rocks thus far identified in land masses reveal the fossilized remains of once living organisms, plant and animal. The coal strata upon which the world of industry so largely depends are essentially but highly compressed and chemically changed vegetable substance. The whole series of chalk deposits and many of our deep-sea limestones contain the skeletal remains of animals. These lived and died, age after age, while the earth was yet unfit for human habitation.

### **From the Simple to the Complex**

From the fossil remains of plants and animals found in the rocks, the scientist points to a very definite order in the sequence of life embodiment, for the older rocks, the earlier formations, reveal to us organisms of simplest structure only, whether of



*Fossils Trilobite Imprints in Sediment*

plants or animals. These primitive species were aquatic; land forms were of later development. Some of these simpler forms of life have persisted until the present time, though with great variation as the result of changing environment.

Geologists say that these very simple forms of plant and animal bodies were succeeded by others more complicated, and in the indestructible record of the rocks they read the story of advancing life from the simple to the more complex, from the single-celled protozoan to the highest animals, from the marine algae to the advanced types of flowering plant — to the apple-tree, the rose, and the oak.

What a fascinating story is inscribed upon the stony pages of the earth's crust! The geologists, who through long and patient effort have learned at least a little of the language in which these truths are written, find the pages illustrated with pictures, which for fidelity of detail excel the best efforts of our modern engravers, lithographers, and half-tone artists. The pictures in the rocks are the originals, the rest at best but copies.

In due course came the crowning work of this creative sequence, the advent of man! Concerning this all-important event we are told that scientists and theologians are at hopeless and irreconcilable variance. I regard that assumption or claim, whichever it be, as an exaggeration. Discrepancies that trouble us now will diminish as our knowledge of pertinent facts is extended. The creator has made record in the rocks for man to decipher, but He has also spoken directly regarding the main stages of progress by which the earth has been brought to be what it is. The accounts can not be fundamentally opposed; one can not contradict the other, though man's interpretation of either may be seriously at fault.

### **Adam a Historic Personage**

So far as the history of man on the earth is concerned the scriptures begin with the account of Adam. True, the geologist does not know Adam by name; but he knows and speaks of man as an early, continuing and present form of earth-life, above and beyond all other living things past or present.

We believe that Adam was a real personage, who stands at the head of his race chronologically. To my mind Adam is a historic personage, not a prehistoric being, unidentified and uncertain.

If the Ussher chronology be correct or even approximately so, the beginning of Adamic history as recorded in scripture dates back about 4,000 years before the birth of Christ. We as a Church believe that the current reckoning of time from the birth of Christ to the present is correct, namely 1,931 years — not from last New Year's day, January 1, but from the month that came to be known among the Hebrews as Nisan or Ahib, corresponding with our late March and early April. So we believe that we are now living in the 1,931st year since the birth of Christ and therefore 5,931 years since the beginning of the Adamic record.

This record of Adam and his posterity is the only scriptural account we have of the appearance of man upon the earth. But we have also a vast and ever-increasing volume of knowledge concerning man, his early habits and customs, his industries and works of art, and his tools and implements, about which such scriptures as we have thus far received are entirely silent. Let us not try to wrest the scriptures in an attempt to explain away what we can not explain. The opening chapters of Genesis and scriptures related thereto were never intended as a text-book of geology, archaeology, earth-science, or man-science. Holy scripture will endure, whereas the conceptions of men change with new discoveries. We do not show reverence for the scriptures when we misapply them through faulty interpretation.

### **Primary and Secondary Causes**

There has been much discussion over the alleged conflict between the teachings of science and the doctrines of the revealed word concerning the origin of man. Let it be remembered that the term "origin" is almost invariably used in a relative sense. The mind of man is unable to grasp the fundamental thought of an absolute or primary origin. Every occurrence man has witnessed is the result of some previously acting cause or purpose, and that cause in turn was the effect or result of causes yet more remote. Perhaps we have never been able to trace an effect to its primary or original cause. Man may say that he understands the origin of an oak in the acorn form from which it sprang, but is not the acorn the fruit of a yet earlier oak and so in reality rather a continuation than a beginning? Yet there is something fascinating in the thought of a beginning; the persistence of a process once started is far less mysterious than its inception.





*View of the Orion Nebula from the Hubble Space Telescope*

It is not enough to refer effects to the First Great Cause; it is unsatisfying and not always reverent to answer questions as to how things came to be what they are by the easy statement that God made them so. With such an answer the scientific man has little patience. The fact that all created things are the works of God and that all processes of nature are due to Him as the administrator of law and order is to the scientific mind an axiom requiring neither argument nor demonstration. The botanist knows that God makes the plant grow, but he, weak mortal, is devoting time and energy of body, mind, and spirit to a study of the way in which God works such a marvelous miracle. The geologist knows that God created the earth, but the best effort of his life is put forth in the hope of finding out in some degree, however small, the method by which the Creator wrought this wondrous world. The astronomer gazing into the starry depths sees in their orderly procession the Lord Eternal walking in His majesty and might, and in humility the student of the heavenly bodies spends days and nights striving to learn a little of the way in which God worked out the marvel of the universe.

In proportion as any one of these may learn of the ways of God, he becomes wise. To be able to think as God thinks, to comprehend in any degree His purposes and methods, is to become in that measure like unto Him and to that extent to be prepared for eventual companionship in His presence. The scientist is busily engaged in the study of secondary causes — the ways and means by which God works and through which He accomplishes His miracle, ever beginning, never ending — and in his search for the truth the student of science scarcely dares lift his eyes to look toward the First Great Cause, the Eternal Power that stands and operates behind and above all the secondary causes, or what we call the processes of Nature.

### **The Origin of Man**

The question involved in the origin of man, therefore, is not raised as a challenge to the belief and declaration that he came to earth through Divine direction, but it is in the nature of an inquiry as to the conditions under which he came. There are many who claim that man's advent upon the earth was effected through processes of evolution from lower forms, processes that had been operative for ages, processes by which man is made kin to the brute and a development from the lowest type of organism. Others affirm that he differs from all mortal creatures of lower rank, not only in degree but in kind, in short that he is not one with the animal creation and that therefore his coming was in no sense a natural and necessary result of earlier animal life. Discussion on this question has developed intense animus, and too often the quest for truth has been lost sight of in the strife for triumph.

In speaking of the origin of man, we generally have reference to the creation of man's body, and of all the mistakes that man has made concerning himself, one of the greatest and the gravest is that of mistaking the body for the man. The body is no more truly the whole man than is the coat the body. The man, as an individual intelligence, existed before his earthly body was framed and shall exist after that body has suffered dissolution. Let it not be assumed that belief in the existence of man's spirit is a concept founded upon scriptural authority only; on the contrary, let it be known that it is in accordance with the best and most advanced scientific thought and philosophic belief of the day to hold that man consists of spirit and body, and Divine revelation makes plain that these together constitute the soul.

We have difficulty in comprehending processes for which we find no analogy in things familiar. Even were it possible for us to know in detail the way in which the body of man was formed and then endowed with the power of procreation, insuring the perpetuity of the race, it would throw but little light upon the subject of the ultimate origin of man. We know but little of things beyond the sphere upon which we live except as information has been revealed by a power superior to that of earth and by an intelligence above that of man. Notwithstanding the assumption that man is the culmination of an evolutionary development from a lower order of beings, we know that the body of man today is in the very form and fashion of his

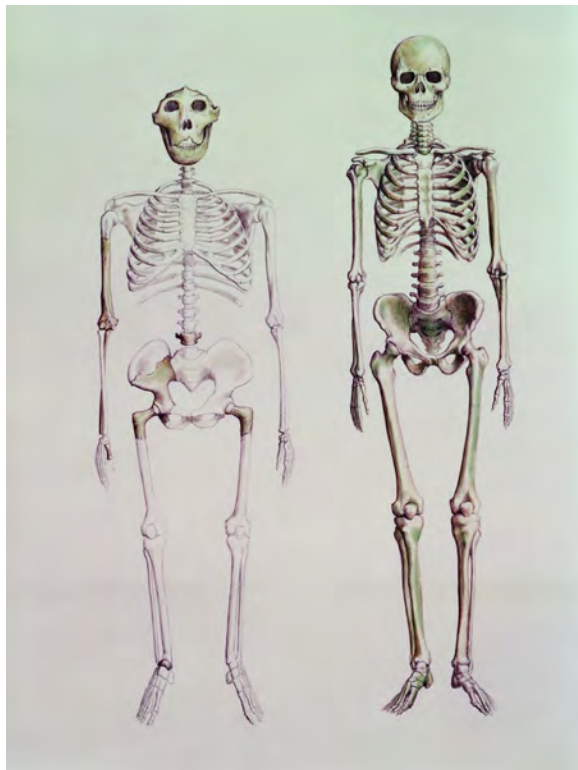
spirit, except indeed for disfigurements and deformities. The perfect body is the counterpart of the perfect spirit, and the two are the constituent entities of the soul.

### By What Standard?

Much depends upon the standard by which we judge as to whether any particular organism shall be pronounced of high or lower rank. By the standard of powers of flight, in which the bird excels, man is a very inferior being; if judged by fleetness of foot, he is far below the deer; by gauge of strength he is inferior to the horse and the elephant, and yet man holds dominion over these and all other living things of earth. In certain important points of body-structure, man stands low in the scale if he be graded strictly in accordance with the accepted standard of mammalian anatomy.

In the course of creative events, the earth came to a condition fitted for the abiding place of the sons and daughters of God, and then Adam came forth upon the earth. But the beginning of man's mortal existence upon the earth was not the beginning of man; he had lived before, even as he shall live after the earth has passed away and its place taken by a new earth and a new heaven.

### Man and the Ape



*Skeletons of Australopithecus Boisei  
and Homo Sapiens*

It has been stated by certain extremists that evolution affirms that man is in the line of posterity from the ape. But scientists today discredit this view. The most that even radical evolutionists assert is that the similarity of structure between man and certain apes indicates the possibility of a common ancestor of the two, but between man and the ape there are more essential differences than resemblances.

True, man does not excel in strength of limb, agility, or speed but in the God-given powers of mind and in the possession of superior ambition and effort. Hear the words of one who until his death was regarded as among the foremost of American geologists, James D. Dana:



Man's origin has thus far no sufficient explanation from science. His close relations in structure to the man-apes are unquestionable. They have the same number of bones with two exceptions, and the bones are the same in kind and structure. The muscles are mostly the same. Both carry their young in their arms. The affiliations strongly suggest community of descent. But the divergencies ... especially the cases of degeneracy in man's structure, exhibited in his palmigrade feet and the primitive character of his teeth, allying him in these respects to the Lower Eocene forms, are admitted proof that he has not descended from any type of ape. In addition, man's erect posture makes the gap a very broad one. The brute, the ape included, has powerful muscles in the back of the neck to carry the head in its horizontal position, while man has no such muscles, as anyone of the species can prove by crawling for a while on "all fours." Beyond this, the great size of the brain, his eminent intellectual and moral qualities, his voice and speech, give him sole title to the position at the head of the kingdoms of life. In this high position, he is able to use Nature as his work-mate, his companion, and his educator, and to find perpetual delight in her harmonies and her revelations. ...

Whatever the results of further search, we may feel assured, in accord with Wallace, who shares with Darwin in the authorship of the theory of Natural Selection, that the intervention of a Power above nature as at the basis of man's development. Believing that Nature exists through the will and ever-acting power of the Divine Being, and that all its great truths, its beauties, its harmonies, are manifestations of His wisdom and power, or, in the words nearly of Wallace, that the whole universe is not merely dependent on, but actually is, the will of one Supreme Intelligence. Nature, with man as its culminant species, is no longer a mystery.<sup>1</sup>

These lines were written before the death of the writer — and constitute his last testament and testimony as to the origin of the species to which he himself belonged.

### **Man's Place in Nature**

In the work already cited, the same author wrote:

Man stands in the successional line of the quadrumana, at the head of the animal kingdom. But he is not a primate among primates. The quadrumana are, as Cuvier called them, quadrumana from the first to the last. They are brute mammals, as is manifested in their carnivore-like canines and their powerful jaws; in their powerful muscular development; in their walking on all fours, and the adaption thereto exhibited in the vertebrae, producing the convexity of the back; and also in other parts of the skeleton. Man, on the contrary, is not quadrumanous. ...

Man was the first being, in the geological succession, capable of an intelligent survey of Nature and a comprehension of her laws; the first capable of augmenting his strength by bending nature to his service, rendering thereby a weak body stronger than all possible animal force; the first capable of deriving happiness from truth and goodness; of apprehending eternal right; of reaching toward a knowledge of self and God; the first, therefore, capable of conscious obedience or disobedience



of a moral law, and the first subject to debasement of his moral nature through his appetites.

There is in man, therefore, a spiritual element in which the brute has no share. His power of indefinite progress, his thoughts and desires that look onward even beyond time, his recognition of spiritual existence and of a Divinity above, all evince a nature that partakes of the infinite and divine. Man is linked to the past through the system of life, of which he is the last, the completing, creation. But, unlike other species of that closing system of the past, he, through his spiritual nature, is more intimately connected with the opening future.<sup>2</sup>

### **A Later Authority**

Let me cite a later authority than Dana. Among the living no anthropologist has been more pronounced in upholding the theories of Darwin and Lamarck than Dr. Henry Fairfield Osborn.

By the theories mentioned man was said to have risen from tree-climbing ape-like ancestors. In his address as retiring president of the American Association for the Advancement of Science, December, 1929, Dr. Osborn affirms the untenability of the views he had so long and aggressively advocated. He regards the human bones unearthed at Piltdown, Sussex, England, as typical of the "Dawn Man," who was in every distinguishing characteristic, a man, not part man and part ape, but as to brain capacity and other evidences of mentality equal to some races now living. Yet Osborn holds to a communal origin of man and anthropoids related in structure, away back in the late Tertiary age of geologic history.

Thus theories come, endure for a season and go, like the fungi of the night; nevertheless they serve their purpose as temporary aids in human thought and endeavor.

### **The Time Element**

The outstanding point of difference between those who take the opening chapters of Genesis and cognate scriptures as the whole and only reliable record of the creation of earth and man, and the students of earth-science who fail to find an adequate record in scripture, is the point of time during which man in some state has lived on the planet.

Geologists and anthropologists say that if the beginning of Adamic history dates back but 6,000 years or less, there must have been races of human sort upon earth long before that time — without denying, however, that Adamic history may be correct, if it be solely regarded solely as the history of the Adamic race.

This view postulates, by application of Dana's affirmation already quoted: "that the intervention of a power above Nature" brought about the placing of, let me say, Adam upon earth.

It is but fair to say that no reconciliation of these opposing concepts has been effected to the satisfaction of both parties. We have not yet learned how to correlate geologic time-periods with terms of years, except as estimates for which no absolutely dependable foundation may be found.

### **Nobility of Adam's Race**

I do not regard Adam as related to — certainly not as descended from — the Neanderthal, the Cro-Magnon, the Peking, or the Piltdown man. Adam came as divinely directed, created, and empowered and stands as the patriarchal head of his posterity — a posterity, who, if true to the laws of God, are heirs to the Priesthood and to the glories of eternal lives.

Were it true that man is a product of evolution from lower forms, it is but reasonable to believe that he will yet develop into something higher. While it is a fact that eternal progression is a characteristic of man's Divine birthright, as yet we have learned nothing to indicate that man shall develop physically into any other form than that in which he now appears.

Many attempts have been made by those who regard man as an animal to frame some definition by which he may be distinctively described among his fellow animals, but of such attempts none have been satisfactorily successful. The difficulty lies in the fact already stated, that man differs from the animal creation not only in degree but in kind; he is the only being who has any concept of a preexistent state or an existence beyond the grave, the only being whose thoughts turn toward God and who feels in his soul the inspiring impulses of kinship to Deity. Believe not



*Garden of Eden, Roelandt Jacobsz Savery, 1576-1639*

those who would make man but little above the brutes when in truth he is but little below the angels and if faithful shall pass by the angels and take his place among the exalted sons of God. The spirit of man is the offspring of the Eternal Father, and his body, if unmarred, is in the very form and fashion of that spirit.

### **The Ante-Mortal State**

We have been told that Jesus Christ is in very truth our Elder Brother, and as to His preexistence in the spirit state, there is little room for question. That His spirit was in the form of the earthly body which He afterward took and which body was slain, buried, and resurrected and with which body He ascended into heaven is attested by scripture. Going back to the time immediately following the dispersion from Babel, we read of a prophet to whom the unembodied Lord revealed Himself, saying: "Behold, this body, which ye now behold, is the body of my spirit; and man have I created after the body of my spirit; and even as I appear unto thee to be in the spirit will I appear unto my people in the flesh" (Ether 3:16).

It is evident from this scripture that in His preexistent state, that is to say in the state in which He existed prior to His earthly birth, Jesus Christ had the same form and stature that He afterward presented in the flesh. By natural processes His spirit shaped for itself a body from the material of earth, which body underwent a course of graded development until it reached maturity, in which state that body was the counterpart to the spirit whose material tabernacle it was. As with Jesus, so with all the sons and daughters of God; each had a spiritual existence before he or she entered upon this stage of mortal existence, and in each case the body is formed and fashioned by the power of the immortal spirit. In this process of body-shaping,





*View of Galaxy Cluster Abell 520 from the Hubble Space Telescope*

the spirit may be hindered, hampered, and interfered with through influences of heredity, through prenatal defects, or through accident and disease.

As to how were formed the bodies of the first human beings to take tabernacles, the revealed word gives no details while science has practically nothing to offer by way of explanation. As Dana so positively declares in the work already cited “Man’s origin has thus far no sufficient explanation from science.”

Man’s mortal existence is but temporary to this earth; he came hither from another realm, in which he lived in an unembodied state and to which, in the natural order, he shall return in a disembodied state following the change known as death. After the Body of the first man had been made ready through the direct operation of the creative power, the spirit of man entered that body. Note the sublimity of the scriptural declaration: “And the Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul” (Genesis 2:7).

### **A Power Above Nature**

In the study of all the created things over which he has dominion, man has found it possible to investigate with some degree of success the secondary causes, or natural processes, through which the creative power has operated to bring about the system that we designate as nature, but in the study of his own eternal self, he is brought at once to the contemplation of the First Great Cause as to his origin. The power that lies at the basis of man’s development is “a Power above Nature.” That is to

say, man, as a mortal being, exists as the result of a special and particular creation. Through graded stages the earth was brought into a state suited to the support of life. In orderly sequence plants and animals appeared, and when at last the world was prepared for its royal ruler, he came, even as had been declared:

And God said, Let us make man in our image, after our likeness; and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth.

So God created man in his own image, in the image of God created he him; male and female created he them.

And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it; and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth. (Genesis 1:26-28).

Such is the declaration of scripture regarding Adam's advent upon earth; and such is a fair summary of our knowledge upon the subject.

### **Evolution, True and False**

Evolution is true so far as it means development, and progress, and advancement in all the works of God, but many of the vagaries that have been made to do duty under that name are so vague as to be unacceptable to the scientific mind. At best, the concept of the development of man's body from the lower forms through evolutionary processes has been but a theory, an unproved hypothesis.<sup>3</sup> Theories may be regarded as the scaffolding upon which the builder stands while placing the blocks of truth in position. It is a grave error to mistake the scaffolding for the wall, the flimsy and temporary structure for the stable and permanent. The scaffolding serves but a passing purpose, important though it be, and is removed as soon as the walls of that part of the edifice of knowledge have been constructed. Theories have their purpose and are indispensable, but they must never be mistaken for demonstrated facts. The Holy Scriptures should not be discredited by theories of men; they can not be discredited by fact and truth. Within the Gospel of Jesus Christ there is room and place for every truth thus far learned by man or yet to be made known. The Gospel is not behind the times; on the contrary, it is up-to-date and ever shall be.

It is natural for the young and immature mind to think that what to it is new must of necessity be new to the world. Comparatively inexperienced students are discovering from time to time apparent discrepancies between the faith of their fathers and the development of modern thought, and these they are apt to magnify and exaggerate, when as a matter of fact, their great-grandfathers met the same seeming difficulties and yet survived. Believe not those who assert that the Gospel of Jesus Christ is in any way opposed to progress or inconsistent with advancement.

### **In the Lineage of Deity**

Man is the child of God; he is born heir to boundless possibilities, the inheritor of the eternities to come. Among mortal beings, the law holds true that the posterity of each shall be after his kind. The child therefore may become like unto the parent, and man may yet attain the rank of godship. He is born in the lineage of Deity, not in the posterity of the brute creation.

I cite my words of an earlier day, with a quotation:

### **Man's Relative Littleness**

The insignificance of man in comparison with the earth on which he dwells and even with the limited topographical features of his world has oft times been dwelt upon. Draw to scale a towering mountain and a man standing at its base or on its summit — what does the man amount to? But then the earth as a planet is small compared with some others of its own system, to say nothing of the relative sizes of earth and sun. In turn, our entire solar system, in the measurement of which miles cease to have meaning — so vast it is — ranks low in dimensions as we gauge it with other families of worlds in the great galaxy of stars to which it belongs, and that immeasurable galaxy is but one among many, and not the greatest of them all.<sup>4</sup>

### **Dream Vision of the Infinite**

This hour is not well suited to the presentation of mathematical data relating to the extent of the universe, though it may permit us to indulge the contemplation of thought-pictures, bewildering though that indulgence may be. John Paul Richter's *Dream Vision of the Infinite* has been brought to English readers through several renditions, and I ask you to follow or accompany me through one of these, generally worded along the lines of the version given us by Thomas DeQuincey:

God called up from dreams a man into the vestibule of heaven, saying "Come thou hither and I will show thee the glories of my house." And to the servants that stood around the throne he said "Take the man and strip from him his robes of flesh; cleanse his vision and put a new breath into his nostrils; only touch not with any change his human heart — the heart that fears and trembles."

It was done; and, with a mighty angel for his guide, the man stood ready for his infinite voyage. Then, from the terraces of heaven, without sound or farewell, they wheeled away into endless space. Sometimes, with solemn flight of angel wing, they fled through Zaarrahs of darkness, through wildernesses of death that divided the worlds of life. Sometimes they swept over frontiers that were quickening under prophetic motions from God.

Then, from a distance that is counted only in heaven, light dawned for a time through a sleepy film. By unutterable pace the light swept to them, they by unutterable pace to the light. In a moment the rushing of planets was upon them; in a moment the blazing of suns was around them.



Then came eternities of twilight, that revealed, but were not revealed. To the right hand and the left towered mighty constellations, that by self-repetitions and answers from afar, that by counterpositions, built up triumphal gates, whose architraves, whose archways — horizontal, upright — rested, rose — at altitudes, by spans — that seemed ghostly from infinitude. Without measure were the architraves, past number were the archways, beyond memory the gates!

Within were stairs that scaled the eternities above, that descended to the eternities below; above was below, below was above to the man stripped of gravitating body. Depth was swallowed up in height insurmountable; height was swallowed up in depth unfathomable. Suddenly, as thus they rode from infinite to infinite,



*Artist's Depiction of Planet Formation*

suddenly as thus they tilted over abysmal worlds, a mighty cry arose — that systems more mysterious, that worlds more billowy, other heights and other depths were coming, were nearing, were at hand!

Then the man sighed and stopped, shuddered and wept. His overladen heart uttered itself in tears; and he said “Angel, I will go no father; for the spirit of man aches with this infinity. Insufferable is the glory of God. Let me lie down in the grave and hide myself from the persecutions of the infinite; for end, I see, there is none!”

And from all the listening stars that shone around issued a choral chant, “The man speaks truly; end is there none that ever yet we heard of.” “End is there none?” the angel solemnly demanded. “Is there, indeed, no end? And is this the sorrow that kills you?” Then the angel threw up his glorious hands to the heaven of heavens, saying “End is there none to the universe of God! Lo, also, there is no beginning!”<sup>5</sup>

### **The Spiritual Grandeur of Man**

What is man in this boundless setting of sublime splendor? I answer you: Potentially now, actually to be, he is greater and grander, more precious according to the arithmetic of God than all the planets and suns of space. For him were they created; they are the handiwork of God; man is His son! In this world man is given dominion over a few things; it is his privilege to achieve supremacy over many things.

“The heavens declare the glory of God; and the firmament showeth His handiwork” (Psalm 19:1). Incomprehensibly grand as are the physical creations of the earth and space, they have been brought into existence as means to an end

necessary to the realization of the supreme purpose, which in the words of the Creator is thus declared:

For behold, this is my work and my glory — to bring to pass the immortality and eternal life of man (Moses 1:39).

It is decreed that this earth shall become a celestialized, glorified sphere; such is the revealed world. Science has nothing to say on the matter; it can neither refute nor prove. But the Lord, even God, hath spoken — and so shall it be! Amen.

*Address Delivered in the Tabernacle, Salt Lake City, Utah Sunday, August 9, 1931. Originally published in the Deseret News, Nov. 21, 1931; subsequently published as a pamphlet by The Church of Jesus Christ of Latter-day Saints, 1931; later published in The Instructor, vol. 100, no. 12 (Dec. 1965), pg. 474-477; continued in vol. 101, no. 1 (Jan. 1966), pp. 9-15. This chapter is a transcription of the 1931 pamphlet.*

### Endnotes

1. James D. Dana, *Manual of Geology Treating of the Principles of the Science with Special References to American Geological History*. Fourth ed. New York City, NY: American Book Company, 1896. <http://www.geology.19thcenturyscience.org/books/1896-Dana-ManGeol/htm/doc-full.html>. (accessed October 31, 2015), p. 1036.
2. *Ibid.*, pp. 1017-18.
3. Speaking of an earlier discourse that Elder Talmage gave on the subject of evolution, Terryl L. Givens, *Wrestling the Angel: The Foundations of Mormon Thought: Cosmos, God, Humanity*. Oxford, England: Oxford University Press, 2015, p. 219 wrote:

That evolution may serve as the vehicle of human bodily creation is not denied. Hence, Talmage would say that “supposing that undeniable proof [of evolution] had been furnished,” the theory cannot account for the origin of the “primordial germ” of life, and in any case, “the body is not the *man*” (his emphasis). Such an account of evolution is false, he concludes, if its adherent “gazes upon the inspiring canvas, and says there was no artist” (J. E. Talmage, *The Theory of Evolution: A Lecture Delivered Before the Utah County Teacher’s Association at Provo City on 8 March 1890*, in *The Essential James E. Talmage*, edited by James P. Harris, Salt Lake City, UT: Signature Books, 1997, pp. 20, 28, 29). In a similar way, Boyd K. Packer suggests that “the theory of evolution ... will have an entirely different dimension when the workings of God in creation are fully revealed” (B. K. Packer, *Ensign* 14:11, November 1984, p. 66). We are “the offspring of God,” he writes, and not “only advanced animals” (B. K. Packer, *Created in the Image of God*, *Ensign* 35:1, January 2005, p. 49).

4. Neither the original pamphlet nor the reprint of the discourse in the *Instructor* give a citation for Elder Talmage's self-reference.
5. Elder Talmage's version of this account parallels the following source, with minor variations: Thomas de Quincey. *The Collected Writings of Thomas de Quincey*, vol. 8, ed. David Masson. London, England: A. & C. Black, 1897. <https://books.google.com/books?id=93t6wuCgulAC> (accessed October 31, 2015), pp. 33-34.



# UNDERSTANDING EVOLUTION: AN LDS SCIENTIFIC PERSPECTIVE

Steven L. Peck

*What the hammer? what the chain?  
In what furnace was thy brain?  
What the anvil? what dread grasp  
Dare its deadly terrors clasp?*

William Blake, *The Tiger*

Out of the heat of a rift valley spring, I walked into the dim cool of the National Museum of Ethiopia in Addis Ababa. I came to see the bones of Lucy, a long extinct species of hominin<sup>1</sup> which had been unearthed from the nearby Awash Valley. I was in West Africa with a colleague from the United Nations in Vienna to observe efforts in tsetse fly eradication. I had already visited the “fly factory” where hundreds of thousands of the sterile, male, blood-sucking flies were being reared in chambers. These sterile males would be released into the wild so that there would be no viable males with which the females could mate. Humans come up with the darnedest things.

It was, however, a free day, and there was nothing I wanted to see more in Ethiopia than the bones of my distant ancestor of the species *Australopithecus afarensis*. A guide named Berhane agreed to take me around the city and show me the sights, especially Lucy. I could not be sure that Lucy was a direct ancestor — I might have been descended from her sister or her cousin’s brother-in-law’s best friend’s auntie, but I was pretty sure her species probably gave rise to mine. It was an exciting moment. Since I had arrived at BYU as a fresh-faced, junior faculty member, I had studied and taught about this little bipedal ape who lived 3.2 million years ago. I approached the display case reverently, although my heart was making such a racket, I expected at any moment someone to shush me. Suddenly there she was: The three-foot incomplete skeleton laid out in a glass case, in a dimmer than expected light. Nevertheless it seemed to give off an almost holy glow. I thought about the ages that separated this grandmother and me. As I looked at the bones, a profound

sense of deep genealogy — even the spirit of Elijah — seemed to swell my heart. I felt a great sense of honor and privilege to behold these fossils with my natural eyes. It was a solemn and profound occasion, one I knew I would always remember and honor.

I looked at Berhane and said, “I can’t believe that I am seeing the actual bones of Lucy. I’ve wanted to see these since I was an undergraduate.”

Berhane looked a little awkwardly at me and said, “Well, you know these aren’t the real bones, right?”

“What?”

“The real bones are on display in Texas right now. These are replicas.”

*Replicas like the ones we used in teaching at BYU.*



Figure 1: *The “Bones” of Lucy*

That our bodies are descended from apes is scientifically beyond dispute. I find great comfort in this. We have evolved. Our ancestors emerged from Lucy or something like her. Our physical genealogy has a rich heritage, passing through primitive, worm-like ancestors, through bony fish, to thick-bodied amphibians, to therapsid reptiles, on to ratty mammals, to primates, apes, and finally a kind of ape that started increasing in cunning, in intelligence, in its ability to run and throw, and in its capacity to reason and use language. And to build a wondrously complex material culture.

The scientific evidence for evolution is overwhelmingly clear. One would have to claim that science is largely uninformative as a way of knowing truth to hold onto the claim that evolution has not been established scientifically. If you don’t believe in evolution, you don’t believe in science. It is that simple.

I have had no problem reconciling my religion with evolution and have come to believe that that the scientific story of our origins offers insights into our faith that are not only important but vital to its mature expression. In the past, some Church

leaders have believed in evolution whereas others have vehemently denied it. For example, in 1954, before the many important scientific findings of the last sixty years had been made, Elder Joseph Fielding Smith wrote:<sup>2</sup>

This brings us to the discussion of what I believe to be the most pernicious doctrine ever entering the mind of man: The theory that man evolved from the lower forms of life. For its source we must go beyond the activities and research of mortal man to the author of evil, who has been an enemy of truth from the beginning before the Earth was formed.

I believe that President Dieter F. Uchtdorf had statements such as these in mind when he said in 2013: “[T]o be perfectly frank, there have been times when members or leaders in the Church have simply made mistakes.”<sup>3</sup> Decades after Elder Smith’s statement was published, Evenson and Jeffrey<sup>4</sup> assembled a valuable, up-to-date collection of authoritative statements on evolution made by leaders of the Church. A study of these statements will reveal that the Church has never had an official stance on organic evolution.

It should be noted that the first formal class in evolution was instituted at BYU in the fall of 1971 with the First Presidency’s approval, and the study of evolution is a required part of the core curriculum of all BYU students in the biological sciences. Evolutionary biology has become one of the largest and most successful graduate programs at BYU. Neither Creationism nor Intelligent Design is taught there.

In this chapter, I will not try to harmonize opposing views on evolution. I take it as axiomatic that evolution in its broad sense is the way the biological world works, although details are still being worked out and amazing discoveries will continue for centuries. Particulars of how it proceeds (such as what role genetics versus epigenetic factors<sup>5</sup> play in enhancing or retarding evolution) are being argued about and debated among scientists in healthy ways. Progress is ongoing. If you currently have suspicions about the scientific evidence for evolution, a short write-up is unlikely to move you from your position. Rather, I would encourage you to dig in and read a couple of books on the topic from well-respected, mainstream scientists so the full weight of the evidence can give you the best chance of being persuaded. What I do want to do instead in this chapter is to walk you through those aspects of evolutionary theory that seem important to a well-developed Mormon perspective.

## Evolution

### **Darwin’s First Observation: We seem to be a little short on elephants. Where are all the elephants?**

To understand evolution we can do no better than to go back to Darwin, who first articulated one of its principal mechanisms, Natural Selection. He observed three things that laid the foundation for his theory. In his magnificent *The Origin of Species* he observes:<sup>6</sup>



There is no exception to the rule that every organic being naturally increases at so high a rate, that if not destroyed the earth would soon be covered by the progeny of a single pair.

To feel the full impact of this observation, I have my students imagine a pair of flies that produce offspring every five days, have an unlimited supply of energy, and don't need males to fertilize their eggs. I ask them to calculate how long it takes to create a ball of flies with the same mass as the planet earth? The answer is only 1.67 years. If you let it run a few more years, pretty soon you have a sphere of flies whose diameter is expanding faster than the speed of light. Life has tremendous reproductive potential. Darwin thinks about it in terms of elephants:<sup>7</sup>



The elephant is reckoned to be the slowest breeder of all known animals, and I have taken some pains to estimate its probable minimum rate of natural increase: it will be under the mark to assume that it breeds when thirty years old, and goes on breeding till ninety years old, bringing forth three pair of young in this interval; if this be so, at the end of the fifth century there would be alive fifteen million elephants, descended from the first pair.

A quick glance at the world, and we find that it is covered with neither flies nor elephants, so something must curtail the potential population growth. It is obvious that unlike the scenarios posited above, real populations need resources to grow: food, shelter, places to live, and for many species, mates. These resources are always limited. This creates the condition with which we are all familiar, one pervasive for all life forms: the struggle for existence. This struggle is ever-present. Things better at managing that struggle than their neighbor are those that survive. They don't

have to be the best, mind you, just better than others. Like the old joke about the two women running from a bear, neither woman has to run faster than a bear, just faster than the other woman.

What determines the winners in this struggle? Small things. Little advantages. Being just a bit more adapted to the environment than those around them. The struggle is so fierce that even small advantages tend to make the difference between surviving long enough to leave offspring or not.

In short, there is a struggle for existence in which there are winners and losers. Those with some advantage tend to win over those without (Not always. Chance plays a role here as well. Sometimes well adapted things can be unlucky, as when the fastest rabbit in the warren just happens to get struck by lightning).

Notice one last thing in the struggle for existence, and this needs to be emphasized: this struggle always takes place in a context, an environment, a location. A place that has particular features to which the organism must respond. This local environment sets the conditions that determine who wins and who loses. Last year's fins were great in the sea, not so good on the beach. And one thing you can count on if you live on earth, these conditions are always changing.

**Darwin's Second Observation: Just like snowflakes, no two barnacles are the same.**



If we are inclined to picture Darwin at all, we are tempted to visualize him standing sea-sick on the deck of the HMS Beagle tromping through the pampas of Argentina, or sitting astride a Galapagos tortoise. However, perhaps a more telling portrait could be offered: his wife Emma at home managing a busy nineteenth century household, his kids learning and going about their lessons and chores

while he, up in his study, pores over his collection of barnacles. For ten years he wrote to collectors around the world for specimens of these crustaceans. Then he carefully dissected them, documenting their morphology, their variations, and the minute details of their anatomies. He ended up writing four monographs on barnacles, two on living varieties, and two on fossil species.

This work established Darwin's reputation as a scientist more persuasively than anything else he had done up to that time and would be foundational in his continued pursuit of, as he called it then, "the species problem." His careful and meticulous work helped him realize one of

the most important facets of living things: they vary. Even organisms of the same species show a wide range of variation, and his work on barnacles drove this home with force and clarity.

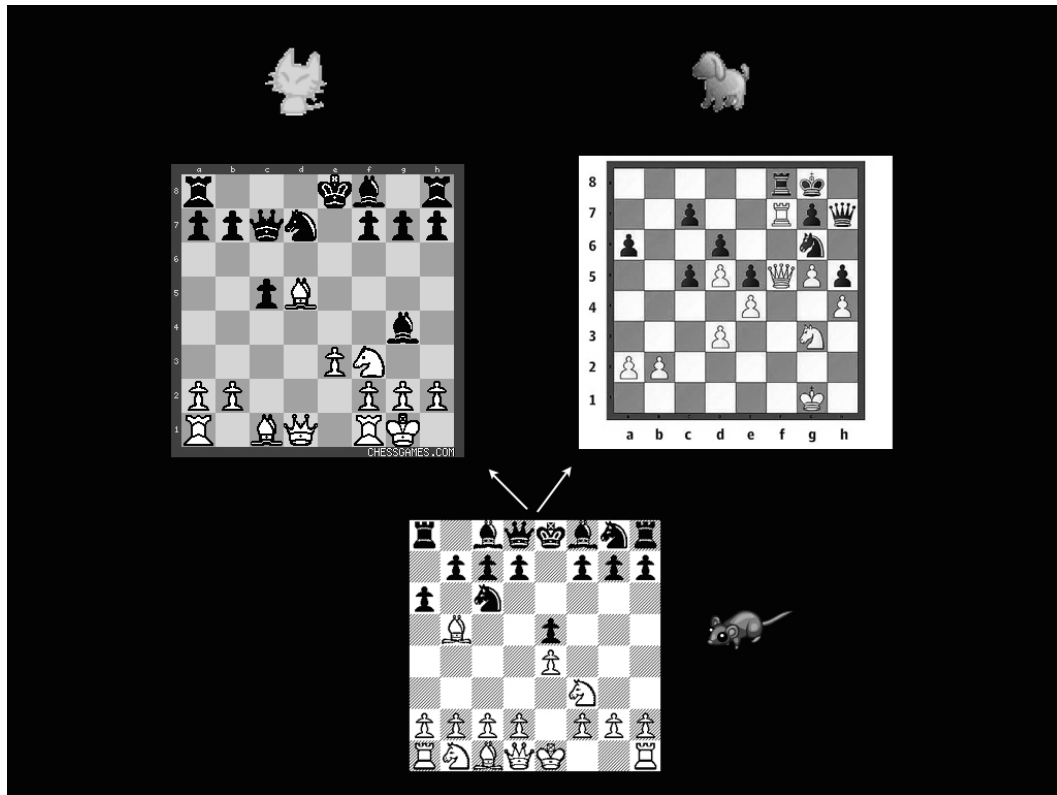
On this variation he realized that speciation did its work. If organisms varied (as with his work on barnacles, he also spent enormous time and expense in writing letters to researchers around the globe, documenting the heterogeneity found in other organisms — everything from pigeons to beetles), then it was on this aspect of populations that the struggle for existence would do its refining work of picking out those variations most adapted to the conditions of their current environment. Over time, this slow process could lead hippo-like creatures to become whales and primitive primates to become humans.

One point here deserves some clarification. Among non-biologists there is a myth that species or “kinds,” as they are often called after the English translation of the Hebrew word designating differences in animals and plants in Genesis, form some sort of barrier over which species cannot cross. As if by making the distinction that different kinds of animals exist, scripture was imposing some sort of immutable law that such distinctions were set in the eternal order of things. This acquired cachet in Christianity’s borrowing from Neo-Platonist ideas on Platonic ideal forms and the great chain of being. If there was an ideal form for each animal, then imagining transitions becomes difficult — is there a form for each transitional type? That seems a little excessive. This was formalized in Natural Theology as the idea of *plenum formarum*, that the creation exhausted all types of possible creatures. All that *were* created are all that *could be* created, and none were not created that could have been. That is what you see in the natural world, all the ideal types there were, and none are missing.



*Drawing of “Cat and Dog Spirits”*

When I was an undergraduate, I encountered something similar to this mistaken view in my BYU Pearl of Great Price class. My teacher drew on the chalkboard a spirit dog and a spirit cat and declared, “Thus we see that evolution is not true



for there can be no spirit that is a mix of the two.” My first thought was that he obviously has not visited the BYU Bean Museum and looked at Shasta the stuffed Liger, which was a mix of a lion and a tiger (which, as Napoleon Dynamite reminds us, are “powerful in magic”). And second, how did my teacher know there could not be transitional spirits? He had mistaken “spirits” for Plato’s “ideal forms,” mistaking doctrines from Plato for those of Joseph Smith and our faith.

Perhaps I can give a better illustration of how biologists think of species by using the game of chess. What you see in the figure above are chessboards with particular configurations. To reach any of these patterns, you must go through a particular set of steps prescribed by the rules of chess. One question you could ask is, given the two configurations at the top of the figure, is it possible to reach those patterns from the third set of piece positions below? That is, could this third configuration be the ancestor of two later arrangements? In the figure, I’ve labeled one pattern “cat” and another “dog.”

We can ask are those two game configurations possible descendants of the rat game arrangement? Are there a series of moves from rat that will take you to cat? Or dog?

Similarly, a real dog and cat can be thought of as constructed by particular configurations of DNA strands and the machinery associated with their production. So one could ask, is there a series of changes in DNA from a rat-like ancestor to a dog and cat? We know a lot about the rules of the DNA game, moves like mutations,

transcription, chromosomal inversions, and so on. There is no boundary one could mark out suggesting that species can't wander into new regions of DNA's possible configurations, changes that we would designate as species when they've traveled far enough from the ancestral type.

In some ways “species” itself is a fraught concept, and there are ongoing debates in biology if species even exist or rather are a way for humans to designate a certain accumulation of variation that have moved too far to allow species to mate properly. “Kinds” would fare the same. In short, imagining that species cannot cross certain boundaries that keep them as species or kind is without warrant — unless you love Neo-platonism so much, you are unwilling to allow science to make progress without first checking in with Plato and his gang to make sure he's okay with the move.

The source of this variation is mutation in the DNA. As indicated previously it is likely that quantum effects make changes to the nucleotide structure of this molecule. Once the change is made, it becomes a part of the genome forever.

### **Darwin's Third Observation: Inheritance and family resemblances (so glad the kids take after their mother)**

In the classic Mormon musical “Saturday's Warrior,” the idea of inheritance is captured in a song in which the cast laments the most defining trait among the family members:

It wouldn't have been so bad  
if it had stayed with old dad  
but we've all got daddy's nose

That offspring resemble parents is an often overlooked requirement for evolution to work. As Darwin points out:

Any variation that is not inherited is unimportant for us. But the number and diversity of inheritable deviations of structure, both those of slight and those on considerable physiological important, is endless . . . No breeder doubts how strong is the tendency to inheritance; like produces like is his fundamental belief.<sup>8</sup>

From those three observations a simple set of inferences set up the principal ideas of evolution. Let's look at these ideas just a little closer.

### **What is Evolution? A Law of Nature, or Just a Way to Sort Your Playing Cards?**

Suppose someone handed you five random playing cards, and you wanted to sort them in numerical order. What would you do? Why, you would use the Shell Straight Insertion method of course! Which means you take out the  $i^{\text{th}}$  (1st, 2nd, so on) until you get  $i^{\text{th}}$  card and place it in order relative to the card next to it. You repeat this until all your cards are in order. It always works. If you follow this procedure,



you will have sorted cards in your hand in no time. If you doubt me, try it. You've probably done it unconsciously if you play cards and you wanted them ordered in your hand.

It always works, not because it is a law but because it's something even more fundamental. It's an *a priori* principle. One can imagine a universe where different laws held, but one cannot imagine a universe where this did not work. This algorithm is based only on the properties of integers and what it means to order them. Like sufficient reason, it underlies logic, not the physical facts of the universe. You can imagine a universe where gravity did not exist, but it would be hard to find one in which  $2 + 2$  did not equal 4.

If you do the sorting algorithm, its success is based upon the same coherence principles that structure all logical relationships. Things can go wrong with sorting, certainly, but the problem will be in the application, not in the principles that underlie the algorithm.

Evolution by natural selection is also a sorting algorithm based on similar *a priori* principles. It is not a law of nature. As philosopher, Christian Illies, points out, it is not just a law, it is a deep principle of reason.<sup>9</sup> Let's be specific. As Darwin pointed out, evolution by natural selection requires three things:

- Variation in traits
- Selection on trait differences (set up by the struggle for existence mentioned above)
- Trait attributes that are inherited by "offspring" from "parents"

I'm using quotes in that last item because this works whether these "offspring" and "parents" are chemicals, digital computer programs, or beans in a jar — anything. That evolution by natural selection works is not really in dispute. It is obviously just a sorting algorithm that sorts things based on some selection criteria like in the card sort used above, usually determined by some environment where the traits vary on how well they reproduce in that environment.

A claim of evolution by natural selection for a population of "whatevers" is simply making the claim that they are just the sort of thing that fits the three criteria above. The algorithm is not in question. Are the biological creatures of the earth the sort of things for which the three criteria hold? That and the specification of an environment are the only empirical facts in question about whether or not life on earth evolves. If organisms on earth meet the three criteria, they will change to better fit their environment. Because environments on earth are always shifting in ways both caused by and in return influence evolution, things on earth evolve. That alone is sufficient to underscore that evolution by natural selection occurs in the natural world. Biologically the answer is a resounding yes. Life on Earth meets all the criteria for this algorithm to work.

Plus we see it in action in populations that evolve on human time scales, such as bacteria and insects becoming resistant to pesticides. We can also infer it by looking at DNA patterns and fossils.

### **Remember Evolution Is Complex**

The last thing I want to do is leave you with the impression that evolution is as simple as running through the simple rules above. While those three things seem to be necessary for evolution to proceed, they are hardly sufficient. There must be ways of using energy to drive the system. There must be structures in place that allow variation and inheritance to continue to exist. The three necessary conditions are not all there is to the story about the rich complexity we find in life on this planet. Recent advances in the fields of developmental biology and ecology have opened a window into the way that genes create feedbacks that affect other genes and even create proteins that can affect their own expression.

Developmental processes are not just genes creating proteins that then simply self-assemble into an organism like pieces of a puzzle or like a thousand monkeys on a thousand typewriters trying to create Shakespeare. Reality is so complex we are just starting to understand it. We can see that it involves emergent processes with things becoming modular and channelized, feedback loops within feedback loops, and monstrosly entangled processes flitting into new pockets of design space. Epigenetic effects (effects not under genetic control) play a role; for example, the condition and makeup of a mother's egg can have striking effects on the offspring. Influences of the environment can induce certain changes on the methylation patterns on an individual's DNA that will block or allow the expression of certain genes. The maternal levels of stress or other environmental influences can affect the developing embryo. This is an exciting field that is defining new possibilities for the way that life evolves. However, this complexity does not change the necessary basic processes described above. How important they are and the extent of other influences are still active and dynamic fields of study. But complexity, emergence, chaos, natural selection, and variation are going to continue to play a role. What those roles are will be a rather sticky wicket. The hard questions always are.

### **What of Intelligent Design? Is That Something Mormons Can Get Behind?**

In the late Middle Ages, there was a twisted group of clerics (an entire underworld of them, it turns out) who wanted information from God. They felt the Deity, however, was being a little cagey about dispensing his almighty power and wisdom, so they put on their thinking caps and pondered, "How can we get God's knowledge when he won't tell us any of the really useful info we want to know?" Well, they came up with a creative albeit malevolent solution that didn't even involve God. Ask demons! The Devil's followers know all this great stuff from the preexistent world from which they fell, so why not bind them and constrain them to give up the goods? Demons are subject to the clergy, right? So back in the fifteenth century they wrote a manual on how to use all this dark power to corner the market on the world's





Scholar with Devils. Illustration from *Omne Borum*, 1360-1375, English School, 14th century

beard, and dressed in white in a secret place outside of town, under a clear sky, on level ground, trace a circle such as appears here with a magnificent sword, writing these names and everything shown along with them. When this is done, place the sword toward the west, on ...

secrets.<sup>10</sup> A manuscript found in Munich is full of recipes for all kinds of wacky hidden, forbidden knowledge. For example, say you wanted a cloak of invisibility (and who doesn't, by the way?) all you have to do is:<sup>11</sup>

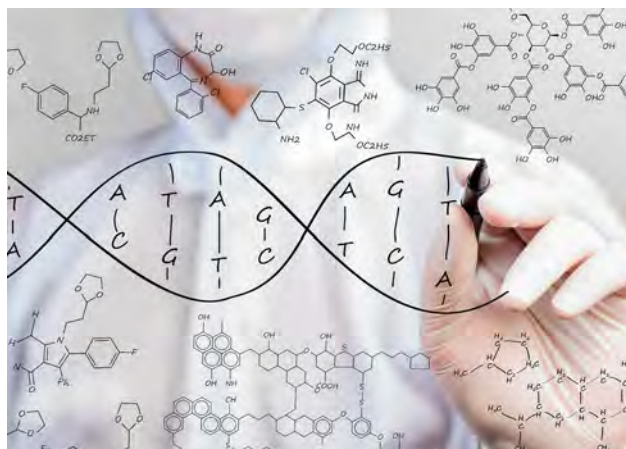
When you wish to become invisible and insensible to all beings, both rational and otherwise, first, under a waxing moon on a Wednesday in the first hour of the day, having remained chaste for three days beforehand, and with cut hair and

Then it goes on with the detailed instructions, gives the names of the demons you must bind and words you must say to constrain them to your will and then, wham, there you have it, a cloak of invisibility. You dismiss the spirits that brought it to you. However, on the third day you have to give back the cloak, or you will be dead in seven days. Nasty business this.

I was thinking about the people who invariably actually tried this. I mean, I am pretty sure they didn't get their cloak of invisibility. But I doubt they realized that their mistake (other than messing with demonic powers, that is) was that they did not have the correct picture of how the world worked. I bet they focused on trying to get the ritual perfected. There are a lot of things that could go wrong with this "experiment" (that's what they really called them [in Latin, of course]). For example, how round does the circle have to be? Are you sure you have a magnificent sword? How true to west? Are you sure your hair was cut properly short? How clear does the sky have to be? What if there is just a little cloud in the sky *way* out there, does it still count as clear? How level is level? I can just see the seeker of the invisibility cloak scratching his head, wondering what he did wrong when his cloak equivalent to the Ring of Gyges doesn't appear.

His hypothesis is probably that there is something wrong with his execution. There is no evidence or fact of the matter that he would likely accept that will convince him that he is just missing something about the way the world really works. He's brought his beliefs about the cloak into the experiment so strongly that he is looking in all the wrong places for what is souring his attempts to score an

über-cool mantle. Indeed, the poor fellow could even do a certain kind of *passé* science on his efforts, using the hypothetico-deductive method (if you think this is all there is to science, you are living in the 1920s) — rejecting hypothesis after hypothesis on what went wrong, assuming all the while that getting your invisible cloak is possible; you just have to get the ritual correct. Getting right how the world works, both physically and spiritually, turns out to matter.



the drawing board, imagination, doubt, belief, asking questions, challenging convention, and, yes it's true, even doing experiments where possible. But its biggest strength, despite well-acknowledged weaknesses, is that it is self-examining and self-correcting. People are in active engagement to find its flaws, reinterpret its findings, and expose its weaknesses. It's a powerful tool. That's why our medicine today is better than that of our grandparents and will likely not be as good as that of our grandchildren.

Hence the invention of science was such a powerful ally in getting the world right. It brings to bear lots of things on finding out how the world works, including, logic, testing, trial and error, creativity, memory, falsification, confirmation, influence of current theory and paradigms, apprenticeships, refining technique, discussion, argument, going back to

One can hardly start talking about the underbelly of an evil clerical underworld, though, without the mind being drawn into thinking about the Intelligent Design Movement (ID). The ID movement was started by a group of Christian scientists who thought they discovered a flaw in evolutionary theory. They noticed biological structures that were hard to imagine as having evolved because they consisted of multiple parts that all had to be in place for the object to work. They used the example of the mousetrap that does not work in pieces but must be assembled wholly to work. Because evolution works only on what is present and useful, they argued that such structures required some divine tinkering to get things over the hump. They rightly noticed that a half a mousetrap would have no selective advantage on its way to becoming a working one, and so evolution would fail in its creation. They proposed a number of biological examples they thought had this attribute, like a mousetrap,



which they coined as “irreducible complexity” like the eye or the flagellum of a bacterium.<sup>12</sup> They wanted to make scientific claims about such structures, but every one they proposed was shown to have a natural evolutionary explanation based on gene structure, physiology, and mechanism.

However, their commitment to science turned out to a pretense. In the words of Terrence Deacon, “Politically, ID is a thinly veiled battle by Christian religious fundamentalists to sneak vestiges of biblical creationism or supernaturalism into the educational system.”<sup>12</sup> The Christian judge of the famous Dover trial, in which a group of Christian fundamentalist attempted to teach their version of creationism in the public schools using Intelligent Design, recognized it as a Trojan horse to get someone’s interpretation of religion taught in the classroom. He wrote, “The overwhelming evidence at trial established that ID is a religious view, a mere re-labeling of creationism, and not a scientific theory.”<sup>13</sup> Intelligent design fails every criterion that demarcates science from pseudo-science, yet it has tremendous appeal because it makes God’s role in creation explicit. It has no research method other than declaring something “irreducibly complex.” In so doing, ID argues that science can no longer investigate that biological phenomenon *because* it is “irreducibly complex.” Thus, it sets arbitrary limits that mandate the ongoing scientific investigation. Isn’t that strange?

Such a sleight of hand is both bad science and bad religion. Sadly, the ID movements seems to have captured an invisibility cloak because for many in the United States, their methods have become “*invisible and insensible to all beings, both rational and otherwise.*” Like the dark clergy mentioned above, they have no interest in understanding the many disciplines that have converged to paint a plausible picture of how the biological world works. Their sole interest is in advancing their simplistic, preconceived views about how they think the biological world *should* work.

The ID movement offers no testable hypotheses, no interpretations of the data in its full complexity, no publications in scientific journals, no explanation of anything beyond what evolution has already explained. Unlike science, it has made made no predictions and has uncovered no significant correspondences among the many disciplines investigating relevant matters. On the other hand, the scientific study of evolution weaves together mutually supportive findings in disciplines as diverse as geology, paleontology, genetics, embryology, anatomy, physiology, neurology, biodiversity, biogeography, agronomy, pharmacology, immunology, epidemiology, neurology, and psychology, and more. Significantly, evolutionary theory also has found practical confirmation in its successful application to problems in computer science, engineering, and mathematics.

Unfortunately, ID arguments have taken on a scientific gloss that has impressed state legislatures across the country. (No big surprise there given what we see from most state legislatures.) However, it is disappointing to see that the ID movement also seems to have been making inroads into the LDS community.<sup>14</sup> Why? Who

knows. Maybe the name sounds like things we just ought to believe. Never mind the content of its claims.

Keep in mind that a firm evolutionary consensus has been increasingly established over many decades using evidence across a wide variety of scientific disciplines. We have to deal with it. We may need to adjust how we think about creation. However, in my view, evolution does not negate by one iota the idea of a purposeful universe that was organized by a loving, intelligent God. Nor does it play havoc with any other of our cherished religious doctrines. Indeed, a vigorous commitment to scientific investigation of evolution — as well as every other aspect of the natural universe — is enjoined specifically in our belief that “truth is knowledge of things as they are, and as they were, and as they are to come” (D&C 93:24).

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### Endnotes

1. Hominins are apes that are taxonomically classified in the same tribe as humans. A Hominid is any of the great apes, although in popular writing “hominid” is often used to reference hominins.
2. Smith, 1954, p. 133.
3. Uchtdorf, 2013, p. 322.
4. Evenson & Jeffery, 2005. These and other statements are also included in the final chapter of the current volume.
5. One of the great stories of evolutionary theory in the twenty-first century is that other things than DNA affect evolution, such as developmental factors and the machinery that houses the genetic program.
6. Darwin & Wilson, 2006.
7. Darwin & Wilson, 2006, p. 491.
8. Darwin & Wilson, 2006, p. 457.
9. Illies, 2005.
10. Kieckhefer, 1998.
11. To anticipate some comments from those who think that evolutionary biologists are inherently evil, no, I haven’t tried to conjure up demons to get an invisibility cloak. (Although I did try to sing once to win a fair woman’s heart, but that went as well as trying to get the invisibility cloak did for the Necromancer clerics.)
12. Behe (1996) originally outlined such arguments. Pallen and Matzke (2006) provide a cogent refutation of the claim that the bacterial flagellum cannot evolve.
12. Deacon, 2012, p. 61.
13. Kitzmiller vs. Dover, 2005.
14. See, e.g., E. H. Ecklund, *Religious Communities*, p. 21, where the percentage of Mormons surveyed who said that creationism (i.e., “God created the universe, the Earth, and all of life within the past 10,000 years”) was “definitely true” (37.9%) was second only to the percentage of Evangelical Protestants who said the same (43.3%). The percentages of other religious groups were much lower: Catholic (19.2%), Mainline Protestant (17.7%), “Something Else” (16.9%), Muslims/Hindus/Buddhist/Sikhs/Jains (9.6%), Jews (6.8%), and Atheist/Agnostic/No Religion (2.8%).



# THE THEORY OF EVOLUTION IS COMPATIBLE WITH BOTH BELIEF AND UNBELIEF IN A SUPREME BEING

David M. Belnap

One of my science teachers in junior high school was especially memorable. His classes and field trips were very interesting, and he was enthusiastic. He greatly stimulated my budding interest in science. For these gifts, I owe him a tremendous debt of gratitude. He also inadvertently helped me learn a valuable lesson in the relationship of science and religion.

One day he introduced my classmates and me to the school's human skeleton. He explained that it was real and came from a young woman whose body had been donated. He showed us that the pelvis was broad and explained that this was characteristic of female skeletons — facilitating the carrying and delivery of children. I was fascinated! He also pointed out the rib cage and told us that men and women have the same number of ribs. Hence, he said, that Bible story about Eve being formed from one of Adam's ribs was not true. (He assumed that if the rib story were true, human males and females would have a different number of ribs.)

At home, I excitedly told my family about the skeleton. I also proudly explained my new understanding of the Adam and Eve story. My devoutly religious parents were not impressed with this new perception. They contacted the school administration to voice their concern that my teacher's comment about Adam and Eve was inappropriate. Nonetheless, what is most impressive was how my parents responded to me.





Instead of jumping into the scriptures and making this conflict a contest between science and religion, they only reasoned with me. With the full support of my father, my mother pointed out that children are still born with arms, legs, eyes, and so forth even if one or both parents lost one or more of those body parts before conceiving the child. Therefore, she patiently reasoned, a rib could have been taken from Adam, and his male children would still have the same number of ribs as his female children.<sup>1,2</sup> As proof of this principle, my parents also noted that baby boys are still born with foreskins even though many generations of their forefathers were circumcised.

My parents were not trained scientists, but their arguments were the perfect response. At the time, my mother and father convinced me that my teacher's interpretation of the biblical rib story was wrong.<sup>3</sup> Now I realize, they also showed me that (1) the use of reasoning, data, and patience is the best way to handle questions between science and religion; (2) these conflicts can be resolved to the detriment of neither scripture nor science; and (3) faulty assumptions are often the cause of such conflicts. My parents' example was invaluable in helping me later reconcile evolution and creation.

### **The Record of Scripture and the Record of Nature**

In the 1850s, Charles Robert Darwin and Alfred Russel Wallace put forth the theory of evolution by natural selection. The theory was incompatible with popular interpretations of the scriptural record of creation, and in the more than fifteen decades since, many have considered the theory an affront to belief in God. Some believers in God argue that evolutionary concepts are heretical and that alternative models can explain the record of nature (i.e., the observations documented by Wallace, Darwin, and many other scientists). Institutions have been set up to promote these non-evolutionary ideas. On the other hand, the overwhelming majority of scientists attest that the record of nature unambiguously shows that evolutionary processes occurred and continue to occur. But because the scriptural account seems incompatible, some evolutionists promote the idea that scripture should be regarded as fictitious tales from an ancient and unenlightened people. To these evolutionists, the theory of evolution validates their belief that God does not exist.

A much quieter group of people — including many scientists — accepts both the record of scripture and the record of nature.<sup>4</sup> For example, most Americans appreciate science and faith in God. Evidence of this duality is the fact that both scientific and

religious institutions are well funded and enjoy broad support in the United States. In general, people who accept both scripture and science are uncomfortable when asked to choose between creation and evolution. Many profess that with advancing knowledge, the controversies will eventually be resolved. However, despite this “middle ground,” the idea persists that evolution is incompatible with belief in God.

The root of the conflict between creation and evolution is a desire for the “golden prize” — physical proof of God’s existence or nonexistence. Therefore, each side in this debate stands to win or lose a cherished conviction, but neither side should claim dominance because the theory of evolution is compatible with both faith in God and faith in atheism.

### **The Theory of Evolution**

Mechanistically, the theory of evolution by means of natural selection can be summarized in two simple principles: First, changes occur in inherited traits.<sup>2</sup> Second, changed traits are selected or rejected.

Characteristics passed from parent to offspring can vary randomly. For example, changes may be mutations within an existing gene, the insertion or deletion of an entire gene or a portion of a gene, or changes to how a gene is regulated. Modifications can also result from normal genetic variation among individuals of the same species as genes are recombined during reproduction.

Selection of changed, inherited traits occurs. Modifications that give offspring advantage are carried forward to successive generations. Unharmful (neutral) mutations or changes also are passed forward. Disadvantageous modifications result in premature death or diminished reproductive capacity, and hence the trait is either not passed on to offspring, or the prevalence of that trait diminishes over time.

Genetic change followed by selection allows successive generations of living things to be modified compared to their ancestors. This process allows organisms to adapt to changing conditions, or the lack of adaptation causes the population to become extinct. Different species can arise from a common ancestor after long periods of time, many changes in traits, a physical separation, or a combination of these events. However, between successive generations, the change may be imperceptible. Rapid changes also have been observed.<sup>5</sup> For example, in some cases when a new animal species was introduced into an area, significant and rapid changes in anatomy, physiology, behavior, or life span have been observed. Adaptations in guppies were observed within only four to eight years (seven to thirteen generations).<sup>6</sup> Studies of lizards showed notable changes within ten to thirty-six years or twenty to thirty generations.<sup>7</sup>

The theory of evolution includes a mechanistic explanation of the diversity of life developing from primitive or ancestral life forms. The theory shows how traits are related among living things. In addition, evolutionary studies often estimate when an organism appeared or disappeared.



*The Origin of Life and Evolution from Single-Celled Organisms to Plants, Animals, and Hominids, Christian Jégou, 1959-*

Evolutionary principles provide powerful tools for understanding biology, including disease. For example, these principles are used to understand and develop treatments for drug-resistant pathogens. Genes in pathogenic organisms mutate, often conferring resistance to drugs such as penicillin. The often-rapid evolutionary response of pathogens prevents many new drugs from being used. Evolutionary principles also help researchers understand how a protein from a bacterium, yeast, plant, worm, fruit fly, fish, mouse, or other organism is relevant to a similar, but mutant and malfunctioning, human protein. Within a person suffering from cancer, malignant cells evolve and compete with healthy cells in the same way that whole organisms evolve and compete with each other.<sup>8</sup>

Evolution theory does not explain *why* the earth was created nor the agent responsible, if any. As far as the theory is concerned, the earth and living things could have a purpose or they could not. They could have been a random accident or the plan of an intelligent Creator. The theory is silent on these matters. Any claim otherwise is conjecture.

On the existence of a Supreme Being, the theory of evolution is no different from any other scientific principle. For example, atomic theory, laws of motion, germ theory of disease, the “Big Bang” theory, and so forth are silent on the question. One may argue that scientific principles are compatible with the existence of God who made an orderly, complex, precisely tuned universe, but no scientific idea proves or requires a Supreme Being. Conversely, one may argue that the universe can be explained through random or accidental processes, but no established scientific principle proves or requires the lack of a Supreme Being.<sup>9</sup> The same reasoning applies to the question of whether life on earth has a purpose. Science only describes physically observable events. Science cannot answer whether God exists and if life on earth has a purpose.<sup>10</sup>

### Just a “Theory”

In scientific language, *theory* means “a well-established set of principles that explains observed phenomena.” An explanation that is not well grounded is a *hypothesis*. Therefore, the common use of *theory* to mean “a guess” or “speculation” does not apply to Darwin’s and Wallace’s ideas. The theory of evolution is well justified in numerous observations and is a foundation principle of modern biology. Like hypotheses, theories can be overturned or modified by new data, but thus far, the theory of evolution has stood for over 150 years. One of the most surprising things about the theory is how well new discoveries have fit with the ideas that Wallace and Darwin proposed in the 1850s.

### The Creation

Divine revelation gives us *why* and *who* answers. The scriptures say that God is responsible and that he created the earth and living things to give humans, his children, a place where we could learn to develop faith and show our willingness to follow the Lord’s commandments.<sup>11</sup>

Although the scriptures give a brief, simplified account of what happened during the Creation, the emphasis is (1) who was responsible, (2) why the earth was created, (3) humans are made in God’s image, (4) humans are to populate the earth and care for the Lord’s handiwork, and (5) physical creations have a spiritual counterpart. Before relating the Creation to Moses, the Lord explained that he created the world (Moses 1:4, 31–34). God also answered Moses’s specific question “why these things are so?” (Moses 1:30): to give us immortality and the opportunity for eternal life (Moses 1:39). The simple story cannot have been intended as a detailed scientific account. The purpose of the scriptures is to explain spiritual concepts, not scientific observations.

### The Conflict

At one extreme of the creation–evolution debate are people who reject divine creation. At the other end are people who reject evolution. Ironically, despite contempt for each other’s point of view, both groups interpret scripture and scientific data in the same way with regards to the creation–evolution controversy: (1) The Genesis account is a literal account of a creation process that took place in six consecutive twenty-four-hour periods (as we currently measure time) and occurred only a few thousand years ago. No symbolism or metaphor exists in the scriptural account. It is a precise description — that is, a scientific document. (2) If the theory of evolution is true, then God cannot exist. (3) If the establishment of life on earth can be explained only by the use of miraculous (i.e., unexplainable or supernatural) processes, then God must exist and must have created the earth. (4) If random processes occur, then God cannot be involved.

The conflict is rooted in the assumption that scientific observations can be used to prove or disprove God. At stake is the desire to once and for all settle the question of God's existence or nonexistence with physical evidence and scientific proof. The biblical declarations that God created the earth have led some to look for evidence of his creative hand in nature; essentially, they have tried to use natural phenomena to prove that God exists. After the theory of evolution was deduced, some have used its postulates to try to prove that God does not exist.

Before the theory of evolution was put forward, scientists assumed that animals and plants were formed in their present states. This was the principal idea that Darwin's and Wallace's work overthrew. Their work and the vast amount of study since showed that present animals and plants have changed or evolved from earlier forms. The pre-evolution idea that animals and plants were formed in their present states was assumed to be consistent with the biblical story. After that conjecture was shown to be scientifically incorrect, many have made another assumption — that God does not exist because the scientific model supposedly based on scripture was found to be erroneous and because evolution involved random events. Consequently, the conflict is between (1) extending the biblical record beyond its intended scope and purpose to say that animals and plants were created in their present form a few thousand years ago or (2) extending the scientific theory beyond its limits to say that God does not exist.<sup>12</sup>

### Evolution Is a Constructive Process

One of Darwin's most effective arguments was his comparison of artificial and natural selection. Humans selected domestic animals and plants based on desired characteristics, he noted, which led to many varieties with vastly different attributes. For example, the dog breeds Great Dane and chihuahua are thought to have a common ancestor, the wolf.<sup>13</sup> Maize, the common grain also known as *corn*, was domesticated from teosinte. Modern maize looks very different from its wild ancestor.<sup>14</sup> These types of artificial selection, Darwin reasoned, were analogous to what nature did through natural selection.

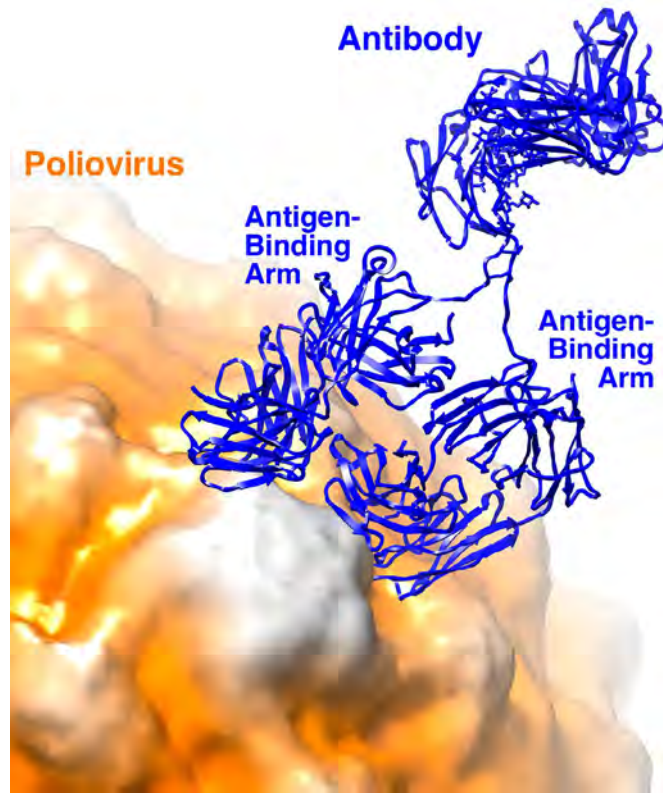
Similar reasoning, comparing artificial and natural evolution, can help us with the creation–evolution controversy. Because random manipulation followed by selection can lead to correct solutions for complex problems and can be used to design machines and proteins, we can deduce that life on earth *could* have developed via evolutionary processes that were put in place by an intelligent Creator.

The seeming randomness of evolution leads many to conclude that evolution must be a godless process. But, must *randomness* mean *godlessness*? Is the evolution of life analogous, as is commonly suggested, to the production of a dictionary via an explosion in a printing shop?

If the complete process were random, then yes, evolution might be like such an explosion. However, evolution is not just a random process. Evolution is a random



procedure followed by a selection mechanism. The combination of random variation followed by selection is a constructive and orderly process. Such a combination is a powerful way to solve physical or mathematical problems that have a large number of potential solutions.<sup>15</sup>



**Figure 1.** *An Example of an Antibody in Action.* An antibody (blue) bound to poliovirus (orange and white).<sup>16</sup> This type of antibody is called an immunoglobulin G (IgG) molecule. It has two identical binding arms, and the two arms bind identically to two symmetry-related sites on the virus. The region bound to the virus is the part of the antibody that has specificity for an antigen. This small region is the part produced by a random process and the only part that varies. Otherwise, antibodies are identical.

For example, antibodies are protein molecules that recognize and chemically attach to foreign objects within our bodies (Figure 1). Once attached, the antibody neutralizes the object or signals an additional response by the immune system. Antibodies can be extremely specific. For example, an antibody to a specific virus will not bind to even closely related viruses. How is such specificity produced? The answer is via a random procedure followed by a selection mechanism.<sup>17</sup>

Every day a human body manufactures millions of B cells; each produces an antibody with randomly different specificity. To make different specificities, a random selection is made from several antibody genes. Then random misalignments occur as the genes are spliced together, giving additional variety. Finally, random mutations may occur within the selected genes. This provides enough different specificities so that the variety of foreign antigens (foreign molecules) encountered can be recognized. The immune system has no way of knowing what new foreign molecules will be present, so randomly generating an enormous number of antibody specificities is an efficient way to be prepared. Each B cell that encounters a foreign object is activated and copied to fight invaders. Cells that do not encounter foreign antigens die or are inactivated. Therefore, the selection process allows “correct” and “incorrect” solutions to be determined. Although antibody production includes a random process and many of the B cells produced are not selected, the overall production is an orderly and efficient way to fight pathogens.

In addition to having a selection mechanism following a random event, evolution of life or evolution in problem solving is iterative. In other words, each generation builds upon the previous one. Complex mathematical problems can be difficult to solve because the path to the solution is unknown, or the solution is one number in a very large set of possibilities. Beginning with an initial estimate or random number and then iterating until a solution converges can be a productive way to find a solution. A key to success is to also have a selective mechanism to choose correct answers from incorrect ones.

In three-dimensional electron microscopy, my own field of research, randomly selecting a starting point can lead to the correct answer (see Figure 2). Objects lie in random, unknown orientations in the electron microscope and are imaged in two dimensions (see Figure 2-A, -B). To properly reconstruct the three-dimensional object, the unknown orientation angles must be determined. My laboratory and other laboratories<sup>18</sup> have shown that assigning random starting angles can lead to the correct result through an iterative process (see Figure 2-C). However, wrong answers are also possible. Proper selection criteria are essential to distinguish correct and incorrect results.<sup>19</sup>

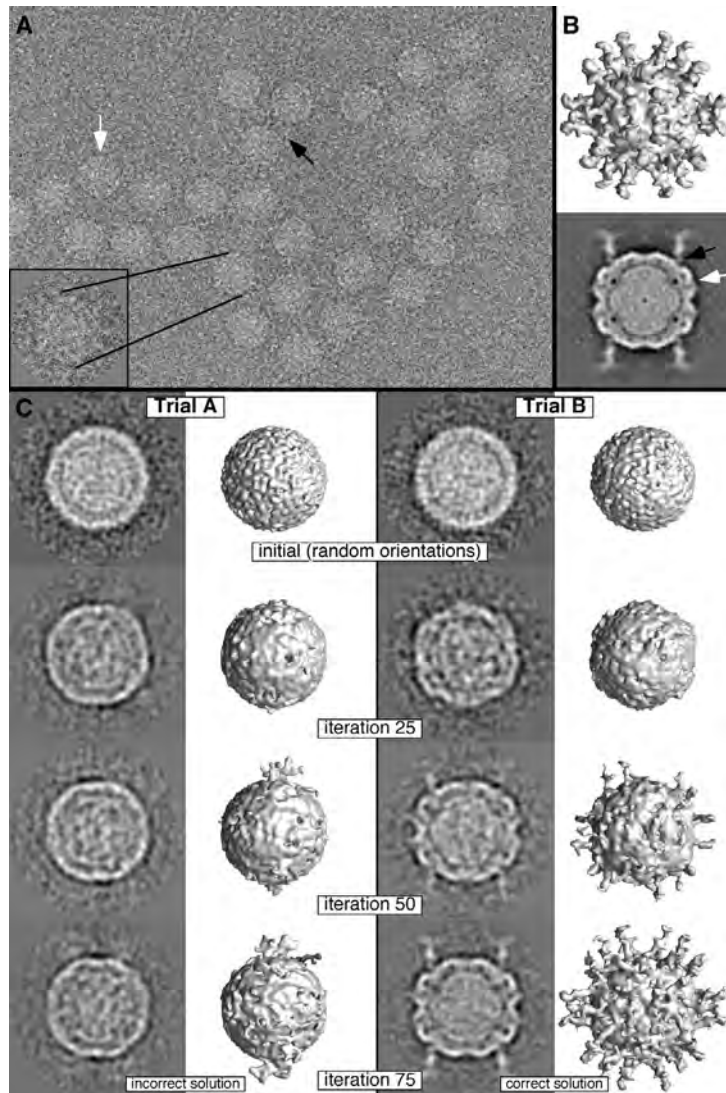
Evolutionary processes can be used to design and build machines.<sup>20</sup> Analogous to evolution of living things,<sup>21</sup> an engineer makes an initial design and then does the following:

1. Random changes (“mutations”) are made in the design. Each random change results in an altered characteristic of the machine.
2. The new machine is constructed and tested. A selection process determines if the change is advantageous or detrimental.

Advantageous changes are kept and used as a starting point for additional “mutations.” Over time, cumulative changes produce an improved machine. Random alterations cause a variety of changes,<sup>22</sup> and the selection process keeps only those modifications that improve or do not debilitate the device. The entire process can be automated in a computer. This significantly improves efficiency because many “generations” can be produced and tested without physically constructing each one.

In 2000, Hod Lipson and Jordan Pollack used this engineering process to build and optimize small machines to crawl across a surface.<sup>23</sup> Each machine could have bars connected by ball joints to allow flexibility, actuators to change the length of a bar to produce movement, and an electrical network (termed “neurons”) to stimulate movement. A standard stepper motor provided propulsion. At the beginning, two hundred separate machines with no bars or neurons were each given random characteristics and allowed to evolve for 300–600 generations. Characteristics that were allowed to mutate included length of bars, number of bars, number of joints, number of neurons, connecting a neuron to a bar (allowing it to become an actuator), and neuronal function. As the authors stated, “Both body (morphology) and brain (control) were thus co-evolved simultaneously.” Selection, or fitness, of each machine was assessed by locomotive ability — each device was tested for how well it could move on a horizontal surface. A machine was selected if it could move





**Figure 2.** Use of a Random Starting Point Followed by Iteration to Solve a Complex Mathematical Problem. In this example, three-dimensional (3D) structures are computed from two-dimensional (2D) images. Poliovirus particles (white arrows) with protein receptors attached (black arrows) are shown.

A) Image of polioviruses recorded in a transmission electron microscope.<sup>24</sup> This 2D view is analogous to an X-ray image of a human body part — that is, the 3D structures of the viruses are superimposed onto a 2D plane. Inset, example of an extracted particle image. Each particle image in the micrograph is

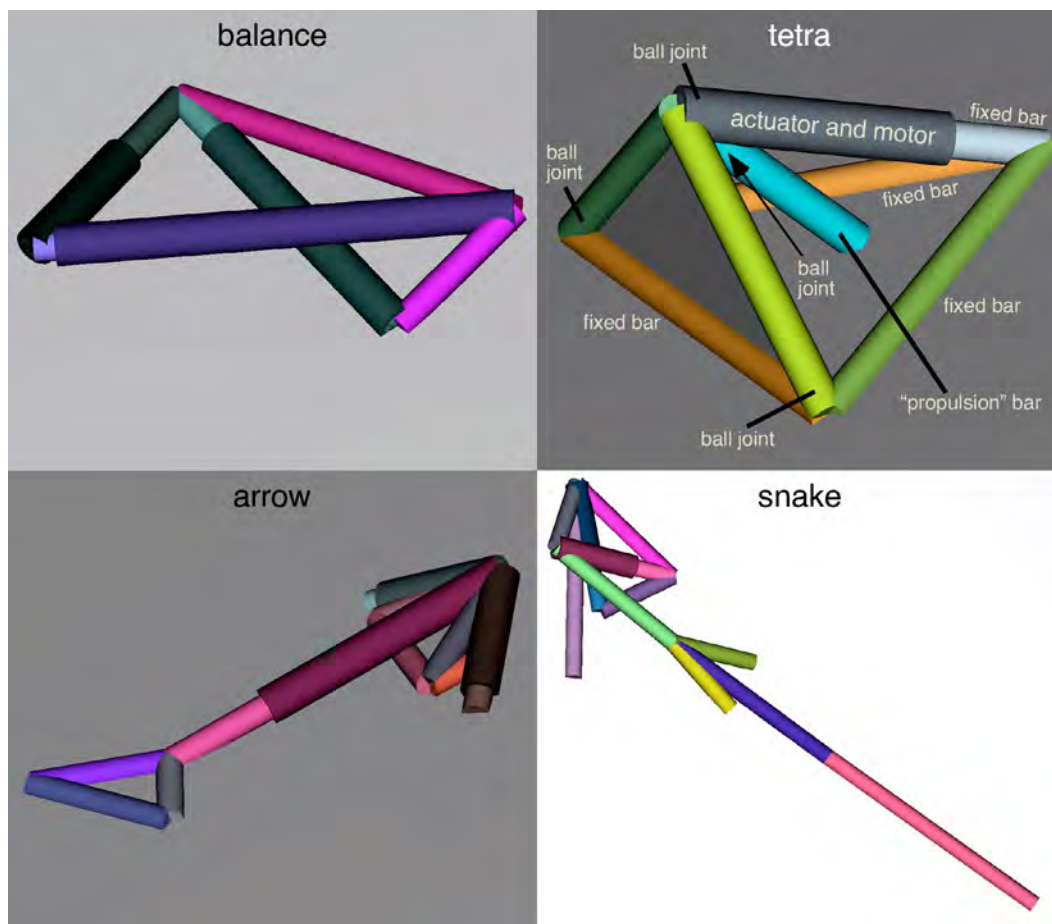
extracted separately and then can be combined with other images to reconstruct the average 3D structure of the poliovirus particle. But first, the view orientation (given by three angles) of each particle image must be determined.

B) Two views of the 3D structure computed from 2D images.<sup>25</sup> Top, a view from the outside. Bottom, a slice through the center.

C) A few thousand particle images were used for these two tests.<sup>26</sup> In each test, each particle image was randomly assigned an initial orientation. A 3D structure was computed (top row). This structure is just a round meaningless blob because the orientation angles are randomly incorrect. Then, an iterative process was begun, and the orientations were allowed to change. After 75 iterations, trial A did not converge to the correct orientations, but trial B did. For comparison, the 3D structure solved from the same 2D data, but by a different method,<sup>27</sup> is shown in panel B.

Panels B and C were adapted from a previous study.<sup>28</sup> Poliovirus is 30 nm in diameter.

farther in a certain time than other machines (Figure 3). Interestingly, this artificial evolution experiment showed similarities to natural, biological evolution: (1) From the similar starting point of the 200 machines, significantly different machines were produced. Differences were both structural and functional. (2) Some machines diverged into different forms. (3) Other machines that had diverged earlier in the experiment converged into similar forms. (4) Despite never being specified or favored, symmetry was found in some machines.



**Figure 3.** Examples of Selected Crawling Machines Produced by the Lipson and Pollack Evolution Experiment.<sup>29</sup> The nicknames for these examples are given at the top of each panel. Parts for the symmetric tetra machine are labeled. Tetra crawled along a surface by a two-step cycle: (1) A power stroke pushed the propulsion bar against the surface propelling the machine forward by a small step. (2) A retraction of the power arm so another step could be taken. Power is from a motor that expands and contracts along a line.

In a process termed *directed evolution*, evolutionary principles are used to design new proteins or alter the functions of existing proteins.<sup>30</sup> Just as the sequence of the twenty-six letters of the alphabet determines the meaning of words and sentences, the sequence of the twenty amino acids determines the structure and function of a protein. In directed evolution of proteins, a person starts with an initial amino-acid sequence, which may be random or based on a known protein. Next, the sequence of amino acids in the protein is altered randomly. All or only some of the amino acids within the protein may be allowed to change. The result is tested. Products

with enhanced function are selected, and products with debilitated function are rejected. The randomization and selection steps are repeated. In addition, multiple trials are necessary to produce the desired output because many runs will not be successful.<sup>31</sup> In one notable example, directed evolution was used to form proteins that could perform an entirely new function.<sup>32</sup>

A common microbiological method is to use evolution to make bacteria or viruses with a desired characteristic. Mutations can be induced by radiation (e.g., ultraviolet light) or chemicals. The researcher then sets up conditions to select for a specific characteristic. For example, in a technique known as bioremediation, many are seeking to use bacteria to clean up toxic chemicals. Commonly, evolution is used to induce or generate organisms to tolerate and metabolize these compounds.

If human beings can use evolutionary principles to design machines and solve problems, an intelligent Creator also could use random variation coupled to selection to produce and maintain life on earth. If humans can use evolutionary means to make microbes or proteins with desired characteristics and the selective process to get desired traits in animals and plants, then a super-intelligent being could have used evolution to physically make people, animals, plants, and microbes.

Evolution is a process that started with simple organisms and then gradually increased to more complex organisms and more complex interactions among living things. Evolution allowed the complexity of life to increase in a natural, orderly way. Evolution allowed, and continues to allow, living things to respond effectively to each other and to environmental changes. As with foreign antigens and antibodies, the situations each species may face are unknown. Randomly generating mutations allows each species to respond to a variety of conditions.<sup>33</sup>

### **“Intelligent Design”**

The idea that an intelligent Creator could have used evolution to form life on earth is much different from the ideas promoted by the “Intelligent Design” movement. Proponents postulated that some biological machines and processes are so complex that evolution could not produce them. However, others showed that such mechanisms could evolve from simpler components.<sup>34</sup> Indeed, the vast complexity of life suggests that evolutionary processes must be involved to improve functionality, allow adaptability, build complexity, and permit trade-offs.

### **Simple Explanations**

Parents, teachers, museum curators, authors, documentary filmmakers, and others use simple explanations to enlighten and educate. They do not intend to deceive or hide important information. Rather, they exclude or minimize details to explain an important principle, process, or event in a way that the intended audience understands. Otherwise, the audience may misunderstand or lose interest. Details can be learned later.

If modern teachers, curators, parents, and others use simple explanations for their audiences, why do some expect the ancient scriptural record to be correct according to our modern understanding of astronomy, geology, and biology? The accounts by Moses and Abraham were written thousands of years ago to people who, for example, understood nomadic agriculture but had little if any understanding of the science that even lay people understand today. The scriptural explanations are very simple and should be taken as such.<sup>35</sup>

When given at different times or to different audiences, simple explanations often vary. For example, depending on a child's maturity, parents give divergent answers to the question "where do babies come from?"<sup>36</sup> Because of differing elements or details, simple explanations given to one audience may seem inconsistent, confusing, or even inappropriate when given to another. Details unimportant in one context may be important in another. Latter-day Saints have four scriptural accounts of the Creation: in the books of Genesis, Moses, and Abraham, and in the temple endowment ceremony. The differences in these narratives — and in particular, as noted by Elder Bruce R. McConkie, the "different division of events" between the temple account and the accounts by Moses and Abraham<sup>37</sup> — suggest that one should indeed view the four renderings as simple descriptions. All accounts relate the most important messages: God was responsible, the divine purpose of Creation, and so forth. Only the details differ.<sup>38</sup>



If we regard the scriptural accounts of the Creation as simple explanations, then remarkable parallels exist between those stories and the record of nature. The fossil record and scripture indicate that initially the earth was barren of life. Then, vegetative life appeared followed by animal life, which began in the sea. Terrestrial animals followed, and humans appeared after other animals.<sup>39</sup>

But, what of the inconsistencies between our current understandings of the scriptural and natural records? For example, Genesis states that the creation occurred in six days, flowering plants appear on the same day as other plants, and whales appear before terrestrial animals. Each of these points disagrees with the record of nature.

Some define each creation "day" as a twenty-four-hour period. Yet, for example,

the fossil record shows millions of years between the first-known fossilized plants and animals. If one imagines teaching the creation to very young children, the use of a day as a metaphor for a creative period is perfectly appropriate. The Hebrew word for *day*, used in the Genesis account, can also be interpreted as an indefinite period of time.<sup>40</sup> Therefore, considering the geologic record, *day* in Genesis 1 most likely means “an unspecified time period.” Because the latter definition is compatible with both the Hebrew text and the fossil record, we can assume this is the correct interpretation.

The other two examples are not as easy to reconcile. However, if we remember the purpose of the story was not to recount a detailed chronology, then the following reasonings may be credible.



Flowering plants reproduce sexually as pollen from the male anther is placed in the female stigma. Genesis states that flowering, or fruit-bearing, plants were created on the same “day” that other plants were created, implying that flowering plants were present before animals appeared. However, in the fossil record, the first-known flowering plants appeared after animals were already in existence. In addition, although some aquatic or terrestrial flowering plants are fertilized as pollen drifts through water or air, most flowers require an animal to transfer the pollen. These plants cannot reproduce if animals are not present to pollinate them. In other words, most flowers are useless without animals. So, is the scriptural record in error in saying flowering plants were formed before animals were formed?

No, to explain simply, one could group flowers with the other plants because the mechanism was in place for flowers to develop. The flowering plants could then evolve with the pollinating animals. Explaining this in the simple biblical story would be an unnecessary detail.

The record of nature indicates that whales evolved from terrestrial animals, but Genesis states that whales were created when aquatic life was created. Rather than explain the complex process of aquatic life leading to terrestrial life followed by some terrestrial animals adapting back to aquatic life, a simpler explanation would be to say that all aquatic life was created on the same “day.” The detail that whales actually came after land animals could be omitted — the mechanism was in place for whales to develop because land animals developed from aquatic ones. Explaining that

whales developed from terrestrial animals would be an unnecessary complication that would likely be misunderstood by the people of Moses's day.

### **An Imperfect World**

One argument for godless evolution is the fact that life is messy and the design is far from ideal. The retina of the vertebrate eye has the sensory layer facing away from incoming light, not towards it. The plant enzyme that converts carbon dioxide to sugars is “notoriously inefficient.”<sup>41</sup> The human mouth grows more teeth than it has room to hold — forcing people to have wisdom teeth extracted; many of us get expensive orthodontic work to straighten the teeth. An intelligent designer, the argument goes, would have made things more intelligently.

In addition, incredible suffering occurs in the world. Not only are human beings often cruel to each other, but animal brutality abounds. For example, as Darwin noted, some wasps are extraordinarily cruel as they lay eggs in living caterpillars and the larvae eat their host alive.<sup>42</sup> Why would a truly loving God make a world with such brutality and inefficiencies? The scriptures provide explanations for these apparent inconsistencies. This is another example in which scripture is compatible with the record of nature.

The scriptures speak of Adam and Eve leaving the peaceful Garden of Eden and entering a world of competing organisms (see Genesis 3:16–19, 23; Moses 4:22–25, 29). Adam and Eve would have to work for their food and other sustenance. The world would contain sorrows. Death would come. Childbirth would be extremely difficult. Wasps cruelly enslaving caterpillars and animals brutally killing each other are consistent with the world where God sent Adam and Eve.

Scripture speaks of God having a perfected body and humans being made in God's image (see Philippians 3:21; Genesis 1:26–27). Therefore, humans are similar to God but not exact copies. Each of us likely has more defects than simply a retinal layer on the opposite side of input light and too many teeth. Therefore, one should not be surprised that life on earth is not perfectly designed. How could it be perfect and be the testing ground that the scriptures say it is? How could you and I develop faith if our bodies were perfect, if we were not challenged by physical limitations?

These gospel teachings are compatible with an imperfect world that came to be through messy evolutionary processes. The argument that a designer would create perfect organs and a perfect world assumes a peaceful, perfect, “Garden of Eden” world, not the messy, competitive, cruel, and sorrowful world into which, the scriptures say, Adam and Eve were sent.<sup>43</sup>

### **Conclusion**

Scientists often express frustration that many people do not accept evolution. The scientists point out the overwhelming biological evidence and cannot comprehend



how anyone can deny that evolutionary processes occurred. On the other hand, believers in God point out the order, complexity, and beauty of nature and cannot fathom how anyone can claim it arose by accident. Are the only alternatives *really* godless evolution and a “miraculous” six-day process? The creation–evolution conflict exists because (1) science has been extended beyond its bounds to say God does not exist and (2) scripture has been extended beyond its bounds to say evolutionary theory is false.

My former teacher erroneously assumed that males should have fewer ribs than females if the Genesis rib story was correct. Likewise, many have surmised similarly unfounded ideas about evolution and creation. If these ideas are tied to deeply held values of faith (in God or atheism), people are reluctant to give them up when confronted with contradictory evidence. Hence, we have conflict. However, data, reasoning, humility, and patience can help us resolve the conflict.

At the root, the creation–evolution conflict presumes that God’s existence or nonexistence can be proven, but attempts to scientifically verify or refute a Supreme Being are futile. The randomness and messiness of evolution does not prove the nonexistence of God, just as the existence of God is not proven by the beauty and order found in nature. Scientific or mechanistic methods do not have the capability to answer questions about God’s existence or the meaning of life. What would be the physical test or observation that would confirm or deny his existence? Besides, the scriptures are clear that belief in God is a choice and cannot be forced on others (e.g., see Alma 30:7–9; Joshua 24:15). People must be free to choose to follow God or not. People cannot be free if his existence is proven scientifically because that proof would be another way people could be forced to follow him. As the scriptures say, faith is hope or belief in “things which are not seen” (Alma 32:21; Hebrews 11:1). If scientific observations are “seen” things and if science cannot prove or disprove God, then faith in atheism and faith in God should be viewed as equivalent positions as far as science is concerned. Logical arguments for either belief can be made.

Therefore, we should call a truce in this war and concede that belief or unbelief in God cannot be proven by current scientific understanding, no matter how much one may wish it to be otherwise. Believers in God need to renounce the notion that evolution must be disproved to save the faith; likewise, atheists need to abandon the idea that evolution is evidence of God’s nonexistence.

Also, some have attempted to resolve the concern of God-fearing people by noting that many scientists believe in God and accept evolution. Merely pointing this out is not enough. Too many believers in God view such people with suspicion. The idea that evolution is incompatible with faith in God has persisted for so long and the conflict is so deep that many believers in God are convinced that if a person starts to accept anything about evolution, the individual will eventually discard his or her faith in God. The scientific community needs to acknowledge that science is neutral on the existence of God and needs particularly to note that the theory of evolution does not disprove the existence of a supreme being.<sup>44</sup>



Believers in God must realize that insistence on a creation model that excludes evolution facilitates the argument by atheistic evolutionists that God does not exist. Believers and prospective believers in God should not have to choose between accepting scientific observations and having faith in God.

If humans can use evolution to construct machines, engineer proteins, produce living organisms with desired characteristics, or solve complicated problems, then certainly a super-intelligent Creator could have used the same principle to create life on earth. But this does not prove that God created life by means of evolution; this reasoning means that evolution is compatible with belief or nonbelief in God. Therefore, faith (in God or atheism) is put back where it should be — on each person's spiritual conviction and choice.

*I thank family members, friends, and colleagues who have helped me develop these ideas and prepare this essay for publication. I also thank the editors and anonymous reviewers for their helpful suggestions.*

### Endnotes

1. My mother told me recently that she thought then of acquired vs. inherited traits (see endnote 2), concepts she had learned in college. My father told me recently that he had a biology teacher in college who left him with the impression that science and scripture were compatible.
2. *Inherited traits* are those an organism inherits from its biological parents and will pass on to its progeny. In humans, these traits include such things as hair color, hair type, eye color, and ear shape. *Acquired traits* give an organism characteristics that are not passed on and include such things as learned behaviors, environmental effects, deliberate actions, and accidents. Cuts, broken bones, amputations, burns, and learned skills are examples of acquired traits.
3. I came to understand then that the authenticity of the Adam and Eve story was not dependent on boys having fewer ribs than girls. However, my parents' reasoning does not prove that the rib story is true. The validity of that story depends on factors beyond human anatomy. In 1976, Spencer W. Kimball (President of The Church of Jesus Christ of Latter-day Saints) said, "The story of the rib, of course, is figurative" ("The Blessings and Responsibilities of Womanhood," *Ensign* 6 (No. 3; March 1976): 71).
4. Examples of scientists who accept evolution and divine creation: Henry Eyring, *Reflections of a Scientist*, ed. H. R. Romney (Salt Lake City: Deseret Book, 1983, 1998); Steven L. Peck, *Evolving Faith: Wanderings of a Mormon Biologist* (Provo,

- Utah, USA: Neal A. Maxwell Institute for Religious Scholarship, Brigham Young University, 2015); Trent D. Stephens, D. Jeffrey Meldrum, and Forrest B. Peterson, *Evolution and Mormonism: A Quest for Understanding* (Salt Lake City: Signature Books, 2001); Daniel J. Fairbanks, *Relics of Eden: The Powerful Evidence of Evolution in Human DNA* (Amherst, NY: Prometheus Books, 2007); Francis S. Collins, *The Language of God: A Scientist Presents Evidence for Belief* (New York: Free Press, 2006); Karl W. Giberson, *Saving Darwin: How to be a Christian and Believe in Evolution* (New York: HarperOne, 2008); Kenneth R. Miller, *Finding Darwin's God: A Scientist's Search for Common Ground between God and Evolution* (New York: HarperCollins, 1999); National Academy of Sciences and Institute of Medicine, *Science, Evolution, and Creationism* (Washington, D.C.: The National Academies Press, 2008), 12, 15, 54; Simon Conway Morris, "Darwin's Compass: How Evolution Discovers the Song of Creation." The Boyle Lecture, London, 23 February 2005, <http://www.stmarylebow.co.uk/#/boyle-lecture-2005/4535725162> (accessed 3 September 2015).
5. Two review articles: S. P. Carroll, A. P. Hendry, D. N. Reznick, and C. W. Fox, "Evolution on Ecological Time-Scales," *Functional Ecology* 21 (June 2007): 387–93; A. P. Hendry, P. Nosil, and L. H. Rieseberg, "The Speed of Ecological Speciation," *Functional Ecology* 21 (June 2007): 455–64.
6. D. N. Reznick, F. H. Shaw, F. H. Rodd, and R. G. Shaw, "Evaluation of the Rate of Evolution in Natural Populations of Guppies (*Poecilia reticulata*)," *Science* 275 (28 Mar. 1997): 1934–37. An earlier study on guppy evolution showed changes within eleven years (thirty to sixty generations); D. A. Reznick, H. Bryga, and J. A. Endler, "Experimentally Induced Life-History Evolution in a Natural Population," *Nature* 346 (26 July 1990): 357–59.
7. A. Herrel, K. Huyghe, B. Vanhooydonck, T. Backeljau, K. Breugelmans, I. Grbac, R. Van Damme, and D. J. Irschick described adaptations that occurred within thirty-six years (approximately thirty generations) in "Rapid Large-Scale Evolutionary Divergence in Morphology and Performance Associated with Exploitation of a Different Dietary Resource," *Proceedings of the National Academy of Sciences of the United States of America* 105 (25 Mar. 2008): 4792–95. Changes within ten to fourteen years were observed by J. B. Losos, K. I. Warhelt, and T. W. Schoener, "Adaptive Differentiation Following Experimental Island Colonization in *Anolis* lizards," *Nature* 387 (1 May 1997): 70–73. Modifications occurring within twenty generations (fifteen years) were reported in Y. E. Stuart, T. S. Campbell, P. A. Hohenlohe, R. G. Reynolds, L. J. Revell, and J. B. Losos, "Rapid Evolution of a Native Species Following Invasion by a Congener," *Science* 346 (24 Oct. 2014): 463–66. An example of rapid evolution in cane toads, which were introduced into Australia to control insects, is found in B. L. Phillips, G. P. Brown, J. K. Webb, and R. Shine, "Invasion and the Evolution of Speed in Toads," *Nature* 439 (16 Feb. 2006): 803.

8. L. M. F. Merlo, J. W. Pepper, B. J. Reid, and C. C. Maley, "Cancer as an Evolutionary and Ecological Process" *Nature Reviews Cancer* 6 (Dec. 2006): 924–35.
9. In mathematics, for example, a person can argue that if  $A = B$  and  $B = C$ , then  $A$  must equal  $C$ . No proof or physical observation says that God exists or does not exist. Therefore, the arguments that observations of nature are consistent with the existence or nonexistence of God are statements of faith. In the Book of Mormon, Alma used an analogous argument to Korihor, who wanted a sign that God exists (see Alma 30:44). Alma tells Korihor that if he wants a sign he should think about the world around him. The earth, life on earth, and the motion of the earth and other planets are testimony of God's existence. However, this is not proof that God exists, and faith is still needed to accept that a Supreme Being created the earth. Faith is also required to accept the atheistic argument that the world can be explained without a supreme Creator. Belief in God comes from spiritual observations (see my chapter in this volume, "Questions and Comments About Evolution," questions 5 and 9).
10. For another perspective on the limitations and assumptions of science, see the discussion of "methodological materialism" in Steven L. Peck, *Evolving Faith*, 12–13. Peck's answer to arguments favoring atheistic evolution is found in the same book on pages 23–44.
11. Genesis 1–2; Moses 1–3; Abraham 3:24–26; 4–5.
12. For a discussion of the social and religious consequences of extending evolution theory beyond its bounds see, for example, Stephen H. Webb, *The Dome of Eden: A New Solution to the Problem of Creation and Evolution* (Eugene, Oregon: Cascade Books, 2010) and Karl W. Giberson, *Saving Darwin: How to be a Christian and Believe in Evolution* (New York: HarperOne, 2008). These consequences include not only support for devastating ideas like racism, but also the reluctance of many people to accept the legitimate scientific claims of evolutionary theory.  
  
Extending scripture beyond its bounds also can have negative social and religious consequences. Henry Eyring said, "Perhaps a believer never does more disservice to religion than to support the truth with bad arguments. The listener spots the obvious errors, becomes impatient, often 'throws out the baby with the bath,' and turns away, even from true religion." (Henry Eyring, *Reflections of a Scientist*, 103.)
13. Or a wolf-like animal that is the common ancestor of both modern wolves and dogs.
14. Assuming modern teosinte resembles the teosinte from which maize was developed.

15. This is not to say evolution does not contain messiness. As noted by many authors, evolution does involve discarding unselected solutions. Often many solutions are not selected. The fossil record shows us that many forms of life have gone extinct. (See, for example, Steven L. Peck, *Evolving Faith*, and Stephen H. Webb, *The Dome of Eden*).
16. J. Lin, N. Cheng, J.M. Hogle, A.C. Steven, and D.M. Belnap, "Conformational Shift of a Major Poliovirus Antigen Confirmed by Immuno-Cryogenic Electron Microscopy," *Journal of Immunology* 191 (No. 2; 15 July 2013) 884–891.
17. S. Tonegawa, "Somatic Generation of Antibody Diversity," *Nature* 302 (14 Apr. 1983): 575–81; C. Branden and J. Tooze, *Introduction to Protein Structure*, 2nd ed. (New York: Garland Publishing, 1999), 302–3; K. Murphy, *Janeway's Immunobiology*, 8th ed. (New York: Garland Science, 2012), 12–16, 157–69, 179–84, 192–94, 275–90, 316–27.
18. E. Sanz-García, A. B. Stewart, and D. M. Belnap, "The Random-Model Method Enables *Ab Initio* Three-Dimensional Reconstruction of Asymmetric Particles and Determination of Particle Symmetry," *Journal of Structural Biology* 171 (Aug. 2010): 216–22 and references therein. See also H. Elmlund, D. Elmlund, and S. Bengio, "PRIME: Probabilistic Initial 3D Model Generation for Single-Particle Cryo-Electron Microscopy," *Structure* 21 (6 Aug. 2013): 1299–306 and J. Vargas, A. L. Álvarez-Cabrera, R. Marabini, J. M. Carazo, and C. O. S. Sorzano "Efficient Initial Volume Determination from Electron Microscopy Images of Single Particles," *Bioinformatics* 30 (15 Oct. 2014): 2891–98.
19. Another example is in X-ray crystallography, a closely related field to 3D electron microscopy. There, crystals of proteins or nucleic acids (DNA or RNA) are placed in an X-ray beam. The resulting patterns are a series of spots. Each spot represents a sinusoidal function with an amplitude and phase. By combining the amplitudes and phases of each spot in the whole pattern, the atomic-resolution structure of the crystallized molecule can be solved. However, only the amplitudes of each spot are known; the phases are unknown and must be determined. One way to determine phases is to use a "genetic algorithm," see S. T. Miller, J. M. Hogle, and D. J. Filman, "*Ab initio* Phasing of High-Symmetry Macromolecular Complexes: Successful Phasing of Authentic Poliovirus Data to 3.0 Å Resolution," *Journal of Molecular Biology* 307 (23 Mar. 2001): 499–512.
20. For example, A. E. Eiben and J. E. Smith, *Introduction to Evolutionary Computing* (Berlin: Springer, 2003), and P. J. Bentley, ed., *Evolutionary Design by Computers* (San Francisco: Morgan Kaufmann, 1999).
21. These methods are also known as "genetic algorithms."

22. Variations can be made throughout the device or only in regions specified by the designer.
23. H. Lipson and J. B. Pollack, "Automatic Design and Manufacture of Robotic Lifeforms," *Nature* 406 (31 Aug. 2000): 974–78. See also commentary by Rodney Brooks, "From Robot Dreams to Reality," *Nature* 406 (31 Aug. 2000): 945–47.
24. D. M. Belnap, B. M. McDermott Jr., D. J. Filman, N. Cheng, B. L. Trus, H. J. Zuccola, V. R. Racaniello, J. M. Hogle, and A. C. Steven, "Three-Dimensional Structure of Poliovirus Receptor Bound to Poliovirus," *Proceedings of the National Academy of Sciences of the United States of America* 97 (4 Jan. 2000): 73–78.
25. Ibid.
26. E. Sanz-García et al., "The Random-Model Method."
27. D. M. Belnap et al., "Three-Dimensional Structure."
28. E. Sanz-García et al., "The Random-Model Method."
29. H. Lipson and J.B. Pollack, "Automatic Design and Manufacture of Robotic Lifeforms," *Nature* 406 (31 Aug. 2000): 974–978. These images were produced by the author (DMB) from data found on the Lipson and Pollack website (<http://www.demo.cs.brandeis.edu/golem/>, accessed 24 November 2015). Their website contains more examples and also movies showing simulated and manufactured machines in action.
30. C. Jäckel, P. Kast, and D. Hilvert, "Protein Design by Directed Evolution," *Annual Reviews of Biophysics* 37 (2008): 153–73. See also, R. Kazlauskas and S. Lutz, "Engineering Enzymes by 'Intelligent' Design," *Current Opinion in Chemical Biology* 13 (Feb. 2009): 1–2 and other articles within that same issue.
31. As was seen in H. Lipson and J. B. Pollack, "Automatic Design and Manufacture of Robotic Lifeforms" and in my laboratory's experiment (Fig. 1C), many trials fail to produce satisfactory results. Therefore, multiple runs are necessary. This is analogous to what happened during the evolution of life as many species became extinct and others survived.
32. The function was catalysis of a chemical reaction for which no known natural enzyme exists. D. Röthlisberger, O. Khersonsky, A. M. Wollacott, L. Jiang, J. DeChancie, J. Betker, J. L. Gallaher, E. A. Althoff, A. Zanghellini, O. Dym, S. Albeck, K. N. Houk, D. S. Tawfik, and D. Baker, "Kemp Elimination Catalysts by Computational Enzyme Design," *Nature* 453 (8 May 2008): 190–95.
33. Another perspective by Steven L. Peck is complementary to what I have written here. Using computer modeling of evolution and other points, he argues that the evolutionary process does not exclude the possibility of a divine Creator.

In other words, a Creator could have set up the conditions or landscape upon which evolution then proceeded. See S. L. Peck, "Randomness, Contingency, and Faith: Is There a Science of Subjectivity?" *Zygon: Journal of Religion and Science* 38 (No. 1; March 2003): 5–23 or *Evolving Faith*, 23–44.

34. See, for example, K. R. Miller, *Finding Darwin's God: A Scientist's Search for Common Ground between God and Evolution* (New York: HarperCollins, 1999), and National Academy of Sciences and Institute of Medicine, *Science, Evolution, and Creationism* (Washington, D.C.: The National Academies Press, 2008).
35. "Let us not try to wrest the scriptures in an attempt to explain away what we cannot explain. The opening chapters of Genesis, and scriptures related thereto, were never intended as a text-book of geology, archeology, earth-science or man-science. ... We do not show reverence for the scriptures when we misapply them through faulty interpretation." James E. Talmage, "The Earth and Man," *The Latter Day Saints' Millennial Star* 93 (No. 53; 31 December 1931), 851–852.

In 1972, Latter-day Saint scholar Sidney B. Sperry noted two different expectations for Middle-Eastern (his term was "Oriental") compared to Western ("Occidental") writing:

We oftentimes read our Bible as though its peoples were English or American and interpret their sayings in terms of our own background and psychology. But the Bible is actually an Oriental book. It was written centuries ago by Oriental people and primarily for Oriental people. . . . In thought and speech the Oriental is an artist; the Occidental, on the other hand, may be thought of as an architect. When speaking, the Oriental paints a scene whose total effect is true, but the details may be inaccurate; the Occidental tends to draw diagrams accurate in detail. When our Lord spoke of the mustard seed as "less than all the seeds that be in the earth," and the plant as "greater than all herbs" (Mark 4:31–32), he was speaking as an Oriental. Any good botanist knows that the mustard seed (sinapi) of which Jesus spoke, though small, is not the smallest of all seeds, nor is the plant greater than all herbs. ("Hebrew Manners and Customs," *Ensign* 2 [May 1972], 29–30.)

36. Stephen H. Webb makes a similar argument:

That God needs to accommodate divine revelation to human limitations is an old idea, but it was given its clearest expression in the work of the sixteenth-century Protestant reformer, John Calvin. Calvin argued that the Bible is absolutely true in content, but its form is an accommodation to our limited reasoning and our lack of direct understanding of the divine. . . . God's knowledge is infinite, and our knowledge is finite. God thus speaks to us like parents speak to their children: patiently, kindly, and considerately. When a mother tells her child that babies come from her stomach, she does not mean that literally, although she is certainly not lying, especially given the elasticity of the word stomach. Babies do come from that general area, but children are

not equipped at a young age to understand all of the details pertaining to the geography of human birth. Mature Christians are even less able to understand all of the details of the heavens, let alone the earth. Sometimes the Bible develops a precise picture of historical events, while at other times it gives us a map, and maps are meant to be read differently than pictures. Stomach is an indication, not a definition. It points at something rather than describing it with any precision. When talking to young children about babies, stomach will have to do. (*The Dome of Eden*, p. 171.)

37. Bruce R. McConkie, "Christ and the Creation," *Ensign* 12 (June 1982), 8–15.
38. The four New Testament accounts of Christ's resurrection are another example of how a simple but important scriptural story is told in multiple ways that are not consistent in detail:
  - In Matthew (28:1–10), two women go to the tomb where they meet one angel who tells them Jesus is risen and instructs them to go tell the other disciples. The two women then meet the risen Jesus on their way to tell the disciples. Jesus instructs them that he will meet the others in Galilee.
  - In Mark (16:1–14), three women meet one "young man" at the tomb. He tells them Jesus is risen and instructs them to tell the other disciples that Jesus will meet them in Galilee. Jesus then appears to Mary Magdalene, who reports this to the other disciples. Afterwards, two disciples traveling "into the country" see Jesus, and they report this to the other disciples. Finally, Jesus appears to the eleven apostles.
  - In Luke (23:55–56; 24:1–49), five or more women meet two "men" at the tomb. The men inform the women that Jesus has risen from the dead. The women return from the tomb and tell the eleven apostles and other disciples. Peter runs to the tomb and finds it empty. Later that day, Jesus appears to two disciples who were walking to Emmaus. The two disciples return to Jerusalem and notify the eleven apostles and other disciples. As the two disciples give their report, Jesus appears to the group.
  - In John (20:1–21), Mary Magdalene goes to the tomb and finds it empty. She hurriedly leaves and informs Peter and John. They run to the tomb and also find it empty. They leave, but Mary, who has returned, sees two angels inside the tomb who ask her why she is weeping. Mary turns away and then sees the risen Jesus. She leaves and tells the disciples she saw Jesus. Later that day, Jesus appears to a group of disciples who are in hiding.



If one focuses on details such as who was at the tomb first, when heavenly messengers appeared, how many heavenly messengers appeared, why the disciples were told to meet Christ in Galilee when he appeared to them later that day in Jerusalem, and so forth, one misses the important fact that Jesus rose from the dead — the consistent and important point in all four accounts! Likewise, if we insist on strict consistency and scientific rigor in the Creation stories, we miss valuable spiritual insights and unique lessons we can learn from each account.

39. Elder James E. Talmage expressed a similar idea: “But this we know, for both revealed and discovered truth, that is to say both scripture and science, so affirm — that plant life antedated animal existence and that animals preceded man as tenants of earth.” James E. Talmage, “The Earth and Man,” *The Latter Day Saints’ Millennial Star* 93 (No. 53; 31 December 1931), 850.
40. See, for example, meanings of the word *Yom* (H3117) in *Strong’s Exhaustive Concordance of the Bible*. See also Greg Neyman, “Word Study – Yom,” Old Earth Creation Ministries, [http://www.oldearth.org/word\\_study\\_yom.htm](http://www.oldearth.org/word_study_yom.htm), accessed 15 Mar. 2015.
41. This chemical reaction is critical to plant and animal life. R. J. Spreitzer and M. E. Salvucci, “RUBISCO: Structure, Regulatory Interactions, and Possibilities for a Better Enzyme,” *Annual Reviews of Plant Biology* 53 (2002): 449–75.
42. “With respect to the theological view of the question. This is always painful to me. I am bewildered. I had no intention to write atheistically. But I own that I cannot see as plainly as others do, and as I should wish to do, evidence of design and beneficence on all sides of us. There seems to me too much misery in the world. I cannot persuade myself that a beneficent and omnipotent God would have designedly created the *Ichneumonidæ* with the express intention of their feeding within the living bodies of Caterpillars, or that a cat should play with mice. Not believing this, I see no necessity in the belief that the eye was expressly designed. On the other hand, I cannot anyhow be contented to view this wonderful universe, and especially the nature of man, and to conclude that everything is the result of brute force. I am inclined to look at everything as resulting from designed laws, with the details, whether good or bad, left to the working out of what we may call chance. Not that this notion at all satisfies me. I feel most deeply that the whole subject is too profound for the human intellect. A dog might as well speculate on the mind of Newton. Let each man hope and believe what he can. Certainly I agree with you that my views are not at all necessarily atheistical. The lightning kills a man, whether a good one or bad one, owing to the excessively complex action of natural laws. A child (who may turn out an idiot) is born by the action of even more complex laws, and I can see no reason why a man, or other animal, may not have been aboriginally produced by other laws, and that all these laws may have been expressly designed by an omniscient Creator, who foresaw every

future event and consequence. But the more I think the more bewildered I become; as indeed I have probably shown by this letter.” Charles Darwin to Asa Gray, 22 May 1860, published in *The Life and Letters of Charles Darwin*, vol. 2, ed. Francis Darwin (London: John Murray, 1887), 311–12.

43. In his book *The Dome of Eden*, theologian Stephen H. Webb proposes a way to reconcile the cruelty of the world (“natural evil”), creation by a loving God, and evolution. Webb, a Roman Catholic, addresses this from a Catholic and Protestant perspective.

Imperfection seems to be an inherent property of mortal life — even in a precise, well-defined field like mathematics. In a devotional address at Brigham Young University, Latter-day Saint mathematician Tyler J. Jarvis related solving difficult mathematical problems to people’s personal lives. He noted that challenging mathematical problems can only be solved imperfectly (or approximated) by current techniques. Often, the perfect answer is not possible. Brother Jarvis urged people to accept imperfection, work to find the best approximation, act on that approximation, and try again. See “That’s How the Light Gets In,” BYU Speech, 9 July 2013, Provo, Utah, USA, available at <http://speeches.byu.edu>.

44. An example of this being done is National Academy of Sciences and Institute of Medicine, *Science, Evolution, and Creationism* (Washington, D.C.: The National Academies Press, 2008). See my chapter in this volume, “Questions and Comments About Evolution,” question 2.

# QUESTIONS AND COMMENTS ABOUT EVOLUTION

David M. Belnap

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The publication of an earlier version of my chapter, “The Theory of Evolution is Compatible with Both Belief and Unbelief in a Supreme Being,” as an article in the *Interpreter: A Journal of Mormon Scripture*<sup>1</sup> generated many comments on the journal website. Here are some thoughts in response to those comments. I have formatted them as questions and answers or as statements and responses.

**1. As shown by some contentious statements on the website, evolution remains controversial among Latter-day Saints. Evolution does not affect what many people do in their daily lives and only seems relevant to biologists. Why should such controversial articles be published in a journal dedicated to building faith among Latter-day Saints?**

Regardless of whether biology, geology, anthropology, or a related field becomes one’s profession or avocation, many of us who learn about evolution are confronted by promoters of atheism who use evolution as evidence of atheism. As evidenced by the popular opinion that evolution and faith in God are incompatible, promotions of atheism can be very compelling. In addition, as seen through the popular media, the orientation of Western culture is becoming more secular. At least part of this trend is because influential people think the biblical creation story is a fable. People need to know that alternatives are reasonable. People need to know that faith in God and acceptance of science are compatible.

I had a teacher in graduate school who promoted a godless point-of-view. One day in a class on biophysical chemistry, my professor said that everything could be explained by chemistry and physics. The context in which he said this and his lack of clarification strongly suggested that he was bearing witness of atheism. Fortunately, I had multiple other examples of scientists who believed in God. A few active members of my Latter-day Saint ward, including one of my bishops, were scientists at Purdue University, which I attended. One of these active members was on my thesis committee. A fellow biology graduate student was a Jew and a good friend. He was very observant in the orthodox tradition. One day I was talking to him and another professor on my thesis committee who belonged to a Protestant church. We were commenting that a poster advertising an upcoming lecture by James D. Watson, the co-discoverer of the structure of DNA, mistakenly called Dr. Watson the “inventor of DNA.” The professor replied that he “prayed to the inventor of DNA every night.” Another good example was my major professor. Before having dinner at his home, his family and I joined hands around the table and prayed. They attended a Protestant church. In one of his children’s bedrooms was a plaque with a very familiar verse: “I am a child of God and He has sent me here ...” All of these good examples were people who also accepted evolution. Another good example was one of my stake presidents who was a plant breeder for an agricultural company. During an interview, he asked me what my field of study was. When I told him it was biochemistry, he voluntarily exclaimed, “Ah! those people that think evolution isn’t real. I use it in my work every day!”

My approach to creation and evolution is not about “sugar-coating” scientific data or doing “mental gymnastics” with the scriptures. I don’t think that is helpful or necessary. I accept the scriptures as truth and scientific observations as fact. Geologist and Apostle James E. Talmage wrote:

Discrepancies that trouble us now will diminish as our knowledge of pertinent facts is extended. The Creator has made record in the rocks for man to decipher; but He has also spoken directly regarding the main stages of progress by which the earth has been brought to be what it is. The accounts cannot be fundamentally opposed; one can not contradict the other; though man’s interpretation of either may be seriously at fault.<sup>2</sup>

The use of evolution in designing proteins and constructing objects is new knowledge that has come into the world. How antibodies are formed is also new knowledge. I think this new knowledge can help us gain new understanding of how God could have formed life on earth. I think this new knowledge can bring us closer to resolving the contentious creation-evolution controversy.

I respect my colleagues and others who are agnostic or atheist in their belief about God. As our faith teaches, we allow each person to believe how he or she chooses (Articles of Faith 1:11). These colleagues and friends have been kind people who have respected my belief in God. I have learned good things from them, even moral lessons. However, people who espouse atheism need to know that evolution is not proof of their point-of-view. Youth, especially, need to know that faithful alternatives exist. Many responses to my article on the *Interpreter* website clearly showed that the idea is prevalent within the Latter-day Saint community that evolution is incompatible with faith in God. This is simply not true, as my active Latter-day Saint brothers and sisters showed me in Indiana and as the U.S. National Academy of Sciences and Institute of Medicine have stated.<sup>3</sup>

Of course, serving other people and the Lord is more important than knowing how God created life on earth. But, reconciling evolution and creation has helped build my faith in God and, hence, helped motivate me to do those more important things.

**2. Evolution claims that undirected, natural processes account for the world. Many scientists hold this view. The creation means that miraculous, directed processes account for life on earth. Only one of these views can be true. If the former is true, then the prophets and scriptures are false.**

A person’s view of creation and evolution can be heavily biased by his or her core religious beliefs and assumptions that come from those beliefs. This is true for most people, including me. (I use the term “religious” broadly to mean any belief system that deals with a person’s beliefs in God, the afterlife, morality and ethics, and so forth. Therefore, I include belief in God or atheism as religious beliefs.) Many people are convinced that if evolution is true God does not exist and if evolution is false

God does exist. Therefore, the stakes are high and emotions very strong. I hope my essay will challenge assumptions that lead believers in God and believers in atheism to conclude that scripture and science are incompatible.

On the *Interpreter* website, several responders to my essay wrote comments that showed they assume that evolution = atheism or evolution = “an accidental process.” These assumptions are not based on science. One person quoted the following statement by the late William Provine, a prominent scientist:

Let me summarize my views on what modern evolutionary biology tells us loud and clear. ... There are no gods, no purposes, and no goal-directed forces of any kind. There is no life after death. When I die, I am absolutely certain that I am going to be dead. That’s the end of me. There is no ultimate foundation for ethics, no ultimate meaning in life, and no free will for humans, either.<sup>4</sup>

This view is a religious view. It is not scientific. The U.S. National Academy of Sciences and Institute of Medicine do not define evolution this way.<sup>5</sup> Their report emphasizes the mechanism of biological evolution. They also emphasize that many scientists find evolution compatible with faith in God. The evolution website sponsored by the University of California at Berkeley notes, “in the scientific community there are thousands of scientists who are devoutly religious and also accept evolution.”<sup>6</sup> Several years ago, the Public Broadcasting Service produced a documentary series on evolution. The website for this series makes clear that evolution is compatible with belief in God:

Does evolution prove there is no God? No. Many people, from evolutionary biologists to important religious figures like Pope John Paul II, contend that the time-tested theory of evolution does not refute the presence of God. They acknowledge that evolution is the description of a process that governs the development of life on Earth. Like other scientific theories, including Copernican theory, atomic theory, and the germ theory of disease, evolution deals only with objects, events, and processes in the material world. Science has nothing to say one way or the other about the existence of God or about people’s spiritual beliefs.<sup>7</sup>

The main difficulty for believers in God is the idea that evolution is a random process. But what are the religious implications of humans using evolution in constructive ways? If a researcher desires a protein to perform a specific function and uses evolution (random changes followed by selection) to achieve that purpose, does that mean that the result was accidental or without design or purpose? No, the designer achieved his or her purpose. Therefore, if God used this same process to create life on earth, should that process undermine belief in him or belief that he created the world?

Yes, many scientists, philosophers, and others believe that evolution is a godless, accidental process. But, must I agree with them? If thousands or millions of our Christian brothers and sisters think Mormonism is unchristian, does that make it so?

**3. You pointed out how flowering-plant and whale evolution can be harmonized with the scriptural Creation accounts. What can you say about the Fall of Adam and Eve and its relationship to evolution?**

After hearing a scientist colleague suggest that the poor or imperfect design of some parts of life was evidence for a godless evolutionary process, I was impressed with how the fallen world would be expected to be imperfect and even cruel, as indicated by the Lord's statement to Adam and Eve that the world would contain sorrows, painful childbirth, thorns, thistles, and sweat (Genesis 3:16–19; Moses 4:22–25). Thorns, thistles, weeds, and sweat suggest the competition among living things that we observe in nature and the hard work people have had to do to compete and survive. These scriptural ideas are consistent with the kind of world that could be created by an evolutionary process where fierce competition occurred and where the design might not be optimal but was adequate. Some claim the “less than optimal design” is evidence of a godless process. I disagree. I think this is another example of the congruence of scripture and nature. (In my chapter, “The Theory of Evolution Is Compatible with Both Belief and Unbelief in a Supreme Being,” in the present volume, see the section entitled “An Imperfect World.”)

The scriptures teach us that Adam and Eve were placed in the Garden of Eden where they lived for a time, were tempted to eat a forbidden fruit, partook of that fruit, and then were expelled from the garden into the harsh outside world. The scriptures and modern prophets tell us the Fall was important for ushering in mortality and was part of God's plan.<sup>8</sup> Just as unanswered questions remain about the Atonement of Christ, many unanswered questions remain about the Fall of Adam and Eve. Most, if not all, of these questions remain outside the realm of science. Nevertheless, the following four ideas have helped me reconcile current Latter-day Saint teachings on the Fall and current scientific understandings about life on earth.

**A. The scriptures indicate that the Garden of Eden was a separate place from the rest of the world (Genesis 2:8, Moses 3:8, Abraham 5:8).** These verses say that Adam was formed before being placed there, suggesting he was formed outside of the Garden of Eden. These statements are consistent with the idea that processes happening outside the Garden could have been very different from the peaceful, ideal environment within the garden. Therefore, life could have developed outside the garden through evolutionary means, with death and other mortal consequences absent from the Garden of Eden.

**B. For Latter-day Saints, authoritative statements come from the First Presidency or from the President of the Church.**<sup>9</sup> Although positions against evolution, sympathetic to evolution, or somewhere in-between (neutral) have been expressed by individual church leaders,<sup>10</sup> the First Presidency has never ruled on “organic evolution” as a biological process, only on the origin of man as a divine creation of God,<sup>11</sup> on the acceptance of demonstrated truths from science, and on the acceptance of diversities of opinion.



In 1931, two Latter-day Saint leaders (Elder Brigham H. Roberts, President of the First Quorum of Seventy, and Elder Joseph Fielding Smith, Jr. a member of the Council of Twelve Apostles) had a disagreement over human evolution that came before the First Presidency.<sup>12</sup> Elder Roberts argued that human-like creatures, formed by evolutionary processes, existed before Adam and Eve. He proposed that these “pre-Adamite” creatures were destroyed in a cataclysmic event and then Adam was brought to earth from another world. Elder Smith stated that no death occurred anywhere on earth before the Fall and that the doctrine of pre-Adamites was not church doctrine. After much discussion, the First Presidency ruled that neither view represented church doctrine:

The statement made by Elder Smith that the existence of pre-Adamites is not a doctrine of the Church is true. It is just as true that the statement: “There were not pre-Adamites upon the earth,” is not a doctrine of the Church. Neither side of the controversy has been accepted as a doctrine at all.

Both parties make the scripture and the statements of men who have been prominent in the affairs of the Church the basis of their contention; neither has produced definite proof in support of his views. ...

We call attention to the fact that when one of the general authorities of the Church makes a definite statement in regard to any doctrine, particularly when the statement is made in a dogmatic declaration of finality, whether he express it as his opinion or not, he is regarded as voicing the Church, and his statements are accepted as the approved doctrines of the Church, which they should be.

Upon the fundamental doctrines of the Church we are all agreed. Our mission is to bear the message of the Restored Gospel to the people of the world. Leave Geology, Biology, Archaeology and Anthropology, no one of which has to do with the salvation of the souls of mankind, to scientific research, while we magnify our calling in the realm of the Church.

We can see no advantage to be gained by a continuation of the discussion to which reference is here made, but on the contrary are certain that it would lead to confusion, division and misunderstanding if carried further. Upon one thing we should all be able to agree, namely, that Presidents Joseph F. Smith, John R. Winder and Anthon H. Lund were right when they said: “Adam is the primal parent of our race.”<sup>13</sup>

Furthermore, the matter of *how* Adam and Eve were divinely created was declared unknown. Speaking of Adam and Eve in 1976, President Spencer W. Kimball said, “We don’t know exactly how their coming into this world happened, and when we’re able to understand it the Lord will tell us.”<sup>14</sup> A statement in 1910 attributed to the First Presidency<sup>15</sup> emphasized that revelation does not say how the mortal bodies of Adam and Eve were created. Among two other possibilities, they stated that their mortal bodies could have “evolved in natural processes to present perfection, through the direction and power of God.”<sup>16, 17</sup> Therefore, as long as a creation mechanism includes God and one accepts the divine origin of God’s

human and other creations, that mechanism is not inconsistent with Latter-day Saint doctrine.

**C. In thinking about the Fall and the Creation, Latter-day Saints and other believers in God often assume that the process of Creation and the Fall was linear — that is, first the earth was created followed by the Fall, which only then introduced death into the world. The implication is that the Fall had to come before death anywhere on earth could occur. Is this premise correct?**

Reconciling evolution and the scriptural teachings of the Fall is much easier if this assumption is incorrect. An unpublished idea presented to me by Larry E. Dahl, Professor Emeritus of Church History and Doctrine at Brigham Young University, suggests this presumption is not valid. Brother Dahl asked, “Could the Fall have been retroactive? Christ’s Atonement was applicable to people who came before it occurred; could not the effects of the Fall also be applicable before it occurred as well as after?”<sup>18</sup> Plants and other animals had to be present for Adam and Eve to live on the earth. Therefore, some creation had to occur before Adam and Eve could be present to instigate the Fall. If evolution is necessary to produce their mortal bodies and the rest of life on earth, if the Fall must occur for God’s children to experience mortality, and if the Fall was retroactive, then no conflict need exist between our current understandings of the scriptures and science. Death and competition could occur before the Fall, as life progressed to the state where humans could exist. After the Creation, Adam, Eve, and a few other living things could have been placed apart (perhaps by a miraculous process<sup>19</sup>) in the special environment of the Garden of Eden, where the Fall could take place. The Fall then legitimized all fallen conditions on the earth.

Because we mortal humans think only in terms of linear time, the idea of the Fall being applied to the future and the past seems strange. But, is this tactic strange to God who is not limited by time (see Alma 40:8)?

**D. Having an incomplete understanding of life is part of living in mortality.** Dilemmas and seemingly conflicting ideas are part of the world in which the Lord sent us to be tested. This is necessary for us to develop faith. Therefore, we should not be surprised that our understanding of events such as the Atonement, Fall, and Creation is incomplete. My faith is the scriptures are true, the observations of science are true, and someday all will be clear:

In that day when the Lord shall come, he shall reveal all things—things which have passed, and hidden things which no man knew, things of the earth, by which it was made, and the purpose and the end thereof — things most precious, things that are above, and things that are beneath, things that are in the earth, and upon the earth, and in heaven. (D&C 101:32–34)

**4. People who promote creationism sincerely believe in God but simply have a different viewpoint of the scriptures and scientific data from you and others.**

I have not intended to spurn people who have sincere beliefs in creationism, Intelligent Design, or atheistic evolution. I respect their beliefs. But whether they know it or not or whether they intend to or not, those supporting and pushing these efforts are trying to prove the existence or non-existence of a creator. Can God's existence be proven?

Of course, many people are simply questioning evolution or divine creation. Sincere questions are worthwhile.

At least some of the evolution-creation conflict is attributable to what people think God is like or other religious teachings. The Restored Gospel gives perspectives that can help you and I see the Creation differently from what other believers in God teach and believe.

- Some theologians suggest that if God had a hand in evolution this makes him responsible for evil and cruelty in the world. They suggest that if evolution occurred it is the domain of Satan and that the physical death brought on by the Fall is an aberration in God's plan. The restored gospel gives us a different perspective. The Fall was part of the Lord's plan.<sup>20</sup> He sent us into a world where competition, cruelty, and disease are present. Death comes to every living thing and is a necessary part of our existence.<sup>21</sup> Although painful, these, and other, difficulties are necessary for us to prioritize and make decisions about what is most important to us (see Abraham 3:24–25). How could we develop faith and how could we make independent choices if we were not subject to a world where we must face difficult situations? How many potentially dangerous or difficult things do parents encourage their children to do—knowing that their child may face excruciating, even life-threatening, challenges in the process? Does this mean the parent is evil? For example, if parents encourage their children to marry but a child's marriage ends in abuse and divorce, does that make the parent responsible for the abuse and divorce?
- During graduate school at Purdue University, I attended a presentation by a representative of the Institute for Creation Research. I think the presenter was the late Henry Morris. The Institute for Creation Research promotes the idea that God created the world in six 24-hour days *ex nihilo* (out of nothing). At the end of Dr. Morris' presentation, the audience was permitted to ask questions. I asked him why matter could not be eternal just as God was eternal. In other words, why is creation *ex nihilo* significant?<sup>22</sup> He replied that if matter was also eternal, then matter would be co-equal with God. That is an assumption he and other people have made. Is their assumption legitimate? What says that if God

and matter are eternal that the two are co-equal? No scripture says that. In fact, the Book of Mormon teaches that both things to act and things to act upon exist (2 Nephi 2:14). Therefore, a better assumption should be that whatever acts is more powerful than whatever is acted upon, and so, if God and matter are eternal, God is above matter. In addition, modern revelation teaches that creation *ex nihilo* is incorrect. Joseph Smith taught that the Creation was a process where God took elements that were also eternal and organized them into the earth.<sup>23</sup> The Lord revealed to Joseph Smith, “the elements are eternal” (D&C 93:33).

**5. Why assume that God will not provide physical evidence of the Creation and other spiritual things? This view seems to indicate you are embarrassed about faith in God.**

My views are motivated in part by the following experience. When I was a student at Brigham Young University, I took a religion class that discussed some of the evidence for the Book of Mormon. For example, we talked about the book coming from a very unlearned young man in a very short time and witnesses who saw the golden plates and never denied their testimonies of that observation, even after leaving the church. I was astonished when my professor insisted that this evidence was not proof that the Book of Mormon was true. He told us we had to get our own spiritual conviction. I did not want to have to work for a spiritual conviction! I wanted the easy way out! My professor explained that those facts were just consistent with the book being true. God seems to give just enough physical or logical evidence to help believers see they are not crazy, but not enough to make belief in him a mathematical-like proof. On the other hand, those who have atheistic beliefs can also find evidence for their position. Faith is required for either belief in God or belief in atheism. The principal evidence that God is the Creator comes from the scriptures. That witness and my own spiritual experiences are what I believe. Secondary evidence is the order, complexity, and beauty of nature (see Alma 30:44). But, our atheist brothers and sisters have a different view from the same secondary evidence.

I am not embarrassed about faith, but I think each of us has to do the spiritual work necessary to build faith. We cannot expect a crutch or an easy way out through scientific proof. That said, I find my faith strengthened by what I learn through science, including evolution. My views are also motivated by scriptural statements that signs follow belief (Mark 16:17; Ether 4:18; Ether 12:6; D&C 58:64). In other words, faith must come first. Then we can see physical things through spiritual eyes. As taught in the Book of Mormon, people can observe physical signs that corroborate spiritual teachings, but without a spiritual foundation, the observed phenomena can be easily excused as mere happenstance (3 Nephi 1–2). Yes, an orderly, beautiful, well-tuned earth is consistent with a divine creator. Yes, many have been motivated to come to God by observing or being in nature. However, those people had spiritual experiences in those situations. The concept that God

truly is the Creator comes to us through revelation. In other words, when I observe nature and “see God,” I see through my spiritual eyes.

What physical observation indicates or could indicate that God was the Creator? Would that observation need to show something that could not be explained by natural means? That seems to be the assumption of creationists, atheistic evolutionists, and Intelligent Designers. Is that premise legitimate? Why could God not apply natural means to create the world? That would still take great skill and knowledge!

If humans can use evolutionary processes for constructive work, then certainly a super-intelligent, omnipotent being could too. This awareness can help all of us realize (1) evolution should not be equated with godlessness and (2) the mechanism is irrelevant to the question of whether God exists or not.

## **6. Evolution says nothing about how the first life began. This is a serious flaw in the theory.**

Evolution is an explanation for how life as we know it today came to be from primitive or ancestral life forms. How the first life form came to be is unknown, although hypotheses exist.

If current scientific understanding is unclear on how the first life started, how is that a flaw in evolutionary theory? Many scientific—and religious—principles raise significant, unanswered questions. Is the law of gravity flawed because it cannot explain how gravity works (i.e., how two objects with mass have an attraction for one another)? Are our beliefs in the Fall and Atonement flawed because we cannot completely explain either one?

The length of time required to answer a question is irrelevant. Some religious and scientific questions are very difficult to answer. How life originated from the sterile earth is one of those questions. As stated, some hypotheses have been made, but nothing is settled yet. One responder on the *Interpreter* website suggested that evolution could not be correct if we have had over one hundred years to answer how the first life came to be and yet we still do not know. You and I must be careful in arguing that many years is enough time to answer a difficult question. One could also argue that two thousand years of Christianity or two hundred years since Joseph Smith’s first revelation is enough time for us to learn how the Fall and Atonement works.

A famous experiment in the 1950s by Harold Urey and Stanley Miller showed that electrical discharges could produce amino acids (the building blocks of proteins) from compounds that may have been found in the atmosphere before life on earth began. Many have surmised that lightning strikes on the pre-biotic earth could have stimulated formation of amino acids and other compounds essential for life, and that this was one of the first steps in how life began. Many have assumed

that this experiment showed that life began as a godless process. Is that assumption legitimate? If lightning occurs, does that mean God was not involved? What would be the evidence that God is or is not involved? We cannot assume that formation of the first life form was some miraculous, supernatural event or that the formation of the first life form is the evidence that will prove God did or did not create the earth. Establishing the first life form could have been a natural process, such as lightning strikes forming amino acids and life being introduced from outer space. Again, the evidence that God was the Creator comes from the scriptures. They say that God was responsible. They do not say the creation was an unnatural, supernatural, or “magical” process. Besides, how could we ever tell from physical evidence if something was produced “miraculously” or by a natural process?

**7. Why do you emphasize that evolution is compatible with atheism as well as belief in God?**

Too much of the creation-evolution controversy has descended into an argument over which side can prove its point-of-view with scientific evidence or logical argument. I have tried to emphasize that science does not take sides in whether God exists or not. Although human use of evolution to construct machines, design proteins, and so forth does indicate that a being more intelligent than us could use the same means to create and maintain life on earth, I also conclude that believers in God need to be aware that this does not prove that God used this mechanism or that God created the world.

**8. Evolution cannot produce biological complexity.**

Lipson’s and Pollack’s engineering experiment and the protein design experiments show that evolution can produce increased complexity and even new functions.<sup>24</sup> The philosophical implications of these experiments are that a being more intelligent than us could have used these same processes to create us and our world. Just because artificial evolution experiments failed in some instances (as one responder noted on the *Interpreter* website) does not mean they will not work. They have worked for others. We humans are likely at a very elementary stage of using this technology. We should not be surprised at failures. The analogous experiments done in my laboratory have not always worked either. My lab’s experiments, Lipson’s and Pollack’s work, and protein design experiments have produced successful results by starting with something randomized.<sup>25</sup> This does not mean that things are happening by chance. Coupling selection to random variation means that this is not “an explosion in a printing shop producing a dictionary.”

**9. Your comment about Intelligent Design was terse. Is not Intelligent Design proposing that God directed the production of life on earth?**

My comment was terse because the purpose of my essay was not to review or critique Intelligent Design. However, for those who might think my ideas were part of that

movement, I felt I needed to clarify that my thesis (that evolution is a constructive process and could have been used by God to form life on earth) was not the same as what people in the Intelligent Design movement are proposing. That is the main point readers should get from the “Intelligent Design” section.

Intelligent Design is controversial.<sup>26</sup> The principal idea behind the movement is that if one discovers a complex object, he or she can infer that an intelligent designer is responsible. This concept is not new. Perhaps most famously, William Paley made an analogy based on a person finding a stone and a watch in a heath.<sup>27</sup> The person would likely infer that the stone was there “naturally” but the watch was made by someone with intelligence, an intelligent designer. Paley then argued that the design apparent in the biological world was evidence of a creator.

The scientific dilemma is the following: how does one show that geological, astronomical, chemical, and biological complexity is indeed the action of a designer or intelligent agent? Unlike our experience with mechanical complexity (e.g., in watches, buildings, and so forth), we humans have not seen how an intelligent creator could have directed the formation of the universe, the earth, and life on earth. As seen so far, formation of the natural world appears to be a process that simply occurred. Nothing seems to indicate the presence or intervention of an intelligent agent—but, again, what is the test that would show the need for or actions of one? Scientific verification cannot be based on faith in scripture, which is the principal evidence for God being the creator.

Intelligent Design proposes that complex biological structures are too intricate to have arisen through natural processes, such as evolution. But, even Paley’s watch was manufactured by natural, not supernatural, processes. In my essay,<sup>1</sup> I have shown that evolution could have been used by a super-intelligent being, an intelligent designer, to make life on earth. Use of that method would appear as a natural process in the fossil record and elsewhere. Therefore, God could still have designed the world and created it through natural, evolutionary processes. Evolution is a principal of construction and can indeed generate increased complexity, as demonstrated by Lipson and Pollack and others (see my chapter “The Theory of Evolution Is Compatible with Both Belief and Unbelief in a Supreme Being” in the present volume). The argument that some biological processes or objects are complex is a moot point if an intelligent agent used evolution to form living things.

Is finding God through science even possible? Alma taught that the world around us “denote[s] there is a God” (Alma 30:44). The Psalmist said, “The heavens declare the glory of God; and the firmament sheweth his handywork” (Psalm 19:1). But, other gospel teachings suggest that belief in God or a sincere seeking for belief must come before a person can recognize the hand of God in signs and wonders (Mark 16:17; Alma 32:26–43; Ether 4:18; 12:6; Moroni 10:4; D&C 58:64). In 1977, President Spencer W. Kimball said,



If I can only make clear this one thing, it will give us a basis on which to build. Man cannot discover God or his ways by mere mental processes. One must be governed by the laws which control the realm into which he is delving. To become a plumber, one must study the laws which govern plumbing. He must know stresses and strains; temperatures at which pipes will freeze; laws which govern steam, hot water, expansion, contraction, and so forth. ... One might be the best of bookkeepers and yet not know anything of electricity. ... One might be a noted theologian and yet be wholly untrained in watchmaking. One might be the author of the law of relativity and yet know nothing of the Creator who originated every law. ...

Any intelligent man may learn what he wants to learn. He may acquire knowledge in any field, though it requires much thought and effort. It takes more than a decade to get a high school diploma; it takes an additional four years for most people to get a college degree; it takes nearly a quarter-century to become a great physician. Why, oh, why do people think they can fathom the most complex spiritual depths without the necessary experimental and laboratory work accompanied by compliance with the laws that govern it? Absurd it is, but you will frequently find popular personalities, who seem never to have lived a single law of God, discoursing in interviews on religion. How ridiculous for such persons to attempt to outline for the world a way of life!

And yet many a financier, politician, college professor, or owner of a gambling club thinks that because he has risen above all his fellowmen in his particular field he knows everything in every field. One cannot know God nor understand his works or plans unless he follows the laws which govern. The spiritual realm, which is just as absolute as is the physical, cannot be understood by the laws of the physical. You do not learn to make electric generators in a seminary. Neither do you learn certain truths about spiritual things in a physics laboratory. You must go to the spiritual laboratory, use the facilities available there, and comply with the governing rules. Then you may know of these truths just as surely, or more surely, than the scientist knows the metals, or the acids, or other elements. It matters little whether one is a plumber, or a banker, or a farmer, for these occupations are secondary; what is most important is what one knows and believes concerning his past and his future and what he does about it.<sup>28</sup>

### Endnotes

1. D.M. Belnap, "The Theory of Evolution Is Compatible with Both Belief and Unbelief in a Supreme Being," *Interpreter: A Journal of Mormon Scripture* 16 (2015): 261–281.
2. "The Earth and Man," *The Latter Day Saints' Millennial Star* 93 (No. 53; 31 December 1931) 851.
3. National Academy of Sciences and Institute of Medicine, *Science, Evolution, and Creationism* (Washington, D.C.: The National Academies Press, 2008).

4. From the transcript of a debate between William B. Provine and Phillip E. Johnson at Stanford University, 30 April 1994; <http://www.arn.org/docs/orpages/orl61/161main.htm>, accessed 29 September 2015.
5. National Academy of Sciences and Institute of Medicine, *Science, Evolution, and Creationism* (Washington, D.C.: The National Academies Press, 2008). Accessible at <http://www.nap.edu/catalog/11876/science-evolution-and-creationism>, accessed 29 September 2015.
6. See [http://evolution.berkeley.edu/evolibrary/misconceptions\\_faq.php#h1](http://evolution.berkeley.edu/evolibrary/misconceptions_faq.php#h1), accessed 29 September 2015.
7. The website also comments on randomness: “Is evolution a random process? Evolution is not a random process. The genetic variation on which natural selection acts may occur randomly, but natural selection itself is not random at all. The survival and reproductive success of an individual is directly related to the ways its inherited traits function in the context of its local environment. Whether or not an individual survives and reproduces depends on whether it has genes that produce traits that are well adapted to its environment.” (<http://www.pbs.org/wgbh/evolution/library/faq/cat01.html>, accessed 29 September 2015.)
8. For example, Richard G. Scott, “Make the Exercise of Faith Your First Priority,” *Ensign* 44 (November 2014): 92–95.
9. *BYU Evolution Packet*, quoted in William E. Evenson and Duane E. Jeffery, *Mormonism and Evolution: The Authoritative LDS Statements* (Salt Lake City: Greg Kofford Books, 2005), 1–38. Since 1992, a packet known as the *BYU Evolution Packet* has been distributed to students at Brigham Young University and to others. The packet contains authoritative statements from the First Presidency with respect to evolution. A complete set of statements contained in this packet, along with notes and additional statements, is also included in a chapter of the present volume.
10. Respectively, examples of a statement against evolution, sympathetic to evolution, and neutral (emphasis is mine in each quote):
  - [Speaking of the fifth day of creation:] Next came fish and fowl and “every living creature” whose abode is “the waters.” Their Creators placed them on the newly organized earth, and they were given the command: “Be fruitful, and multiply, and fill the waters in the sea; and let fowl multiply in the earth.” This command—as with a similar decree given to man and applicable to all animal life—they could not then keep, but they soon would be able to do so. Appended to this command to multiply was the heaven-sent restriction that the creatures in the waters could only bring forth “after their kind,” and that “every winged fowl” could only bring forth “after his kind.” *There was no provision for evolvment or change from one species to another.* (See Moses 2:20–23; Abraham 4:20–23). (Elder Bruce R. McConkie, “Christ and the Creation,” *Ensign* 12 (June 1982): 8–15).

- Science dominated by the spirit of religion is the key [to] progress and the hope of the future. For example, *evolution's beautiful theory of the creation of the world* offers many perplexing problems to the inquiring mind. Inevitably, a teacher who denies divine agency in creation, who insists there is no intelligent purpose in it, will infest the student with the thought that all may be chance. I say, that no youth should be so led without a counter-balancing thought. (President David O. McKay, "A Message for L.D.S. College Youth," speech, Brigham Young University, Provo, Utah, USA, 8 October 1952, pp. 6–7; quoted in Evenson and Jeffery, *Mormonism and Evolution*, 100–102.)
- The simple truth is that we cannot fully comprehend the Atonement and Resurrection of Christ and we will not adequately appreciate the unique purpose of His birth or His death — in other words, there is no way to truly celebrate Christmas or Easter — without understanding that there was an actual Adam and Eve who fell from an actual Eden, with all the consequences that fall carried with it.

*I do not know the details of what happened on this planet before that*, but I do know these two were created under the divine hand of God, that for a time they lived alone in a paradisiacal setting where there was neither human death nor future family, and that through a sequence of choices they transgressed a commandment of God which required that they leave their garden setting but which allowed them to have children before facing physical death. (Elder Jeffrey R. Holland, "Where Justice, Love, and Mercy Meet," *Ensign* 45 (May 2015): 104–106.)

11. Of course, the heavens, earth, and non-human forms of life also are understood to be divinely created.
12. James B. Allen, "The Story of *The Truth, The Way, The Life*," *BYU Studies* 33 (No. 4; 1993), 690–741.
13. Memo from the First Presidency, 5 April 1931, quoted in Evenson and Jeffery, *Mormonism and Evolution*, 54–67.
14. "Man became a living soul—mankind, male and female. The Creators breathed into their nostrils the breath of life and man and woman became living souls. We don't know exactly how their coming into this world happened, and when we're able to understand it the Lord will tell us." Spencer W. Kimball, "The Blessings and Responsibilities of Womanhood," *Ensign* 6 (No. 3; March 1976): 72.
15. Though unsigned, the statement was published in the monthly column of instructions from the First Presidency (see Evenson and Jeffery, *Mormonism and Evolution*, 42–44).
16. *Improvement Era* 13 (No. 6; April 1910): 570. Here is the statement in its entirety:

**Origin of Man.**— "In just what manner did the mortal bodies of Adam and Eve come into existence on this earth?" This question comes from several High Priests' quorums.

Of course, all are familiar with the statements in Genesis 1: 26, 27; 2: 7; also in Moses 2:27 and Abraham 5:7. The latter statement reads: “And the Gods formed man from the dust of the ground, and took his spirit (that is, the man’s spirit) and put it into him; and breathed into his nostrils the breath of life, and man became a living soul.”

These are the authentic statements of the scriptures, ancient and modern, and it is best to rest with these, until the Lord shall see fit to give more light on the subject. Whether the mortal bodies of man evolved in natural processes to present perfection, through the direction and power of God; whether the first parents of our generations, Adam and Eve, were transplanted from another sphere, with immortal tabernacles, which became corrupted through sin and the partaking of natural foods, in the process of time; whether they were born here in mortality, as other mortals have been, are questions not fully answered in the revealed word of God. For helpful discussion of the subject, see *Improvement Era*, Vol. XI, August 1908, No. 10, page 778, article, “Creation and Growth of Adam;” also article by the First Presidency, “Origin of Man,” Vol. XIII, No. 1, page 75, 1909.

17. For other statements on creation and evolution by Presidents of the Church or statements approved by the First Presidency, see Evenson and Jeffery, *Mormonism and Evolution*. These statements and others are also reproduced in a chapter of the present volume. One other statement is worth noting here. In 1911, Joseph F. Smith highlighted the then contested scientific controversies surrounding evolution and asked that the theory and its accompanying speculations not be taught in church schools at that time. Although expressing doubts about the theory and worries that people who had accepted evolution had then “discarded the Bible,” he also emphasized that “the church itself has no philosophy about the *modus operandi* employed by the Lord in His creation of the world.” (Joseph F. Smith, “Philosophy and the Church Schools,” *Juvenile Instructor* 46 (No. 4; April 1911), 208–209, emphasis in original; quoted in Evenson and Jeffrey, *Mormonism and Evolution*, 45–50).
18. For a similar idea, see the chapter by Trent D. Stephens, “Who Is Adam?” in the present volume.
19. For example, a miracle such as that used by the Lord to allow some of his disciples to remain on the earth without tasting of death, see 3 Nephi 28:4–15. Of course, church leaders such as Elder James E. Talmage, himself a scientist, taught:

Miracles are commonly regarded as occurrences in opposition to the laws of nature. Such a conception is plainly erroneous, for the laws of nature are inviolable. However, as human understanding of these laws is at best but imperfect, events strictly in accordance with natural law may appear contrary thereto. The entire constitution of nature is founded on system and order. (J. E. Talmage, *The Articles of Faith*. 1924 Revised ed. *Classics in Mormon Literature*. [Salt Lake City: Deseret Book, 1984], 20).

20. For example, Richard G. Scott, “Make the Exercise of Faith Your First Priority,” *Ensign* 44 (November 2014): 92–95.

21. For example, Russell M. Nelson, “Doors of Death,” *Ensign* 22 (May 1992): 72–74.
22. An audience member near me commented to me afterwards that my question sounded like something a Mormon would say. I was happy to tell him that I was a Mormon.
23. *Teachings of the Prophet Joseph Smith*, compiled by Joseph Fielding Smith (Salt Lake City: Deseret Book, 1977), 350–352.
24. See “Evolution Is a Constructive Process” section in my chapter, “The Theory of Evolution Is Compatible with Both Belief and Unbelief in a Supreme Being” in the present volume.
25. Ibid.
26. For example, William A. Dembski, *The Design Revolution: Answering the Toughest Questions about Intelligent Design* (Nottingham, England: Inter-Varsity Press, 2004) and Matt Young and Taner Edis, Eds. *Why Intelligent Design Fails: A Scientific Critique of the New Creationism* (New Brunswick, New Jersey: Rutgers University Press, 2004).
27. William Paley, *Natural Theology or Evidence of the Existence and Attributes of the Deity, collected from the appearances of nature*, Matthew D. Eddy and David Knight, Eds. (Oxford: Oxford University Press, 2006). This book was first published in 1802 and has since been reprinted by many publishers.
28. Spencer W. Kimball, “Absolute Truth,” speech, Brigham Young University, Provo, Utah, USA, 6 September 1977. Available at <http://speeches.byu.edu> and *Ensign* 8 (September 1978) 2–8.



# WHO IS ADAM?

Trent D. Stephens

On December 18, 1994, three explorers, Eliette Brunel-Deschamps, Christian Hillaire, and Jean-Marie Chauvet, discovered a most remarkable cave along the Ardèche River in southern France, now known as Chauvet Cave. The deepest, darkest recesses of the cave housed a unique, spectacular art gallery. Mostly created in charcoal, with some red ochre, the paintings on the cave walls, which had been scraped down to a light, prepared surface, depict at least thirteen different species of animals in such remarkable detail that the artists clearly had first-hand knowledge of the subject animals — many of them now long-since extinct.



A female cave lion is shown snarling at her apparent mate. A now extinct horse is shown with its mouth open as though winded from running. Several paintings show animals as though in motion, as though seen in time-lapse drawings. The hand prints of one artist found in several places in the cave exhibit the detail of a crooked little finger. The sensitivity, the humanity, the individuality of this art is remarkable.

These paintings are among the greatest works of art in the world. In technique, in quality, in artistic ability, they rank among the best works of art ever created. The pieces have the freshness of having been painted yesterday — but carbon-14 dating puts them at 30,000 to 35,000 years ago. The cave entrance collapsed some 29,000 years ago sealing the cave as a time capsule until its discovery in 1994.

The works of art suggest that their creators had a deep spiritual side. Bone flutes found nearby can play the same notes that we use in composing music today. Were these sensitive, artistic, spiritual people the children of Adam? Did the Garden of Eden exist sometime in the distant past — sometime before 35,000 years ago?

There were also Neanderthals roaming the Ardèche River Valley when the cave paintings were being created. Recent DNA evidence suggests that the early human cave artists interbred with the Neanderthals. We today carry DNA markers from those Neanderthal ancestors, as well as from those remote cave artists. Are the Neanderthals also the children of Adam?



*Adam and Eve in the Garden of Eden*  
Cathedral of St. Michael and St. Gudula, Brussels

Some calculations, based entirely on Biblical chronology, place Adam and the Garden of Eden at a time approximately 6,000 years ago. In fact, Archbishop James Ussher calculated the first day of creation to have occurred 6,020 years ago, on October 23, 4004 BC. If Adam was the “first man,” then how does his proposed presence 6,000 years ago square with the presence of artistic, spiritually minded humans 35,000 years ago?

There are two common solutions to this apparent dilemma:

1. The 35,000-year date must be wrong because we “know” that Adam was indeed the first man, who lived 6,000 years ago, and no humans could have existed before him. Proposed older dates for the existence of any living thing, let alone humans, is the fabrication of godless scientists who are trying to destroy faith.
2. The whole notion of Adam is a myth — the fabrication of superstitious, frightened minds. Alternatively, in an attempt to modernize the myth, it is claimed that “Adam” is only figurative and not a single, literal person.



For most people, one of these two explanations is the only one possible. These two dichotomous ideas create the basis of a great chasm between science and faith. For at least the past 150 years, most people have lined up on one side of the chasm or the other, and have often hated those on the other side of the rift.

But where do these two opposing solutions leave a person of faith who is also a scientist? How does a person of faith in the power of God, who also has faith in the power of the scientific method, reconcile this apparent chasm between belief in a literal, actual Adam and acceptance of data revealing actual people, capable of creating sensitive, spiritual paintings 35,000 years ago? Is there any way to bridge the chasm?

Some people have attempted to solve the dilemma by suggesting that hominids living 35,000 years ago, before Adam, were not actually human and that Adam was the first true human, the first to have a spirit. Others propose that Adam lived earlier than 6,000 years ago, at a time when *Homo sapiens* first gained spiritual insight. If the cave artists of 35,000 years ago were exhibiting spiritual insight, then Adam must have predated them. Burial rites, which may be characterized as evidence of religious behavior, date as far back as 300,000 years ago, to the first appearance of *Homo sapiens* and even *Homo neanderthalensis*. There is clear evidence of anatomically modern human ritual burials from 100,000 years ago in Israel, where the bones were deliberately stained with red ochre. By 27,000 years ago, burials included grave goods, such as shells, clothing, dolls, and jewelry, suggesting belief in an after-life. Where does Adam fall into this timeline of human spirituality?

It is my opinion that chasing after an elusive date to place Adam as the first man to have spiritual insight, to believe in God and an after-life, is problematic in the extreme. Furthermore, the story of Adam and Eve, as given in the scriptures, is clearly an agricultural story, placing the events no more than 12,000 years ago, when the first signs of plant and animal domestication appear: "... Abel was a keeper of sheep, but Cain was a tiller of the ground."<sup>1</sup>

The solution of denying spirits to pre-Adamic people is not at all satisfactory to me for it denies the obvious spirituality of those very talented cave artists, whose paintings and music can rank with the very best created today. The solution of trying to place Adam at the beginning of human spirituality is equally problematic because such a solution places him long before the agricultural era, thus negating the story of Adam and Eve in the scriptures. The idea of making Adam plural and suggesting that the stories of Adam and Eve and Cain and Abel in the scriptures are only figurative is also not a satisfactory solution in my mind because it tends to render modern scripture referring to Adam as a specific individual as merely figurative. Is there no way to reconcile a literal Adam, living some 6,000 — 12,000 years ago with modern scientific data?

There must be some other, more satisfactory answer. After wrestling with this dilemma for years, I have come to another, very unusual conclusion. My conclusion



*Jehovah Creates the Earth, 2000, Walter Rane (1949-)*

is so far outside the box, it is likely I may become a target for both the religious and the scientific side of the chasm, both of whom would probably very happily join forces in tossing me over the brink into the depths of the rift.

We, who are faithful members of The Church of Jesus Christ of Latter-day Saints, understand that we all lived as premortal spirit children of God before we were born on earth.<sup>2</sup> We also understand that there was a Grand Council in Heaven before the foundation of the World. We apparently all attended that council and marveled at the great plan of our God<sup>3</sup> and shouted for joy at its outcome.<sup>4</sup> At that council, Satan, who was from the beginning, "... came before ... [God], saying — Behold, here am I, send me, I will be thy son, and I will redeem all mankind, that one soul shall not be lost, and surely I will do it; wherefore give me thine honor."<sup>5</sup> Then God's "... Beloved, which was my Beloved and Chosen from the beginning, said unto me — Father, thy will be done, and the glory be thine forever." We are told that Satan then rebelled against God, "... and sought to destroy the agency of man, which I, the Lord God, had given him, and also, that I should give unto him mine own power; by the power of mine Only Begotten, I caused that he should be cast down; And he became Satan, yea, even the devil, the father of all lies, to deceive and to blind men, and to lead them captive at his will, even as many as would not hearken unto my voice."<sup>6</sup>

Abraham 3:22-28 gives a slightly different, more poetic account of the council:

Now the Lord had shown unto me, Abraham, the intelligences that were organized before the world was; and among all these there were many of the noble and great ones; And God saw these souls that they were good, and he stood in the midst of them, and he said: These I will make my rulers; for he stood among those that were spirits, and he saw that they were good; and he said unto me: Abraham, thou art

one of them; thou wast chosen before thou wast born. And there stood one among them that was like unto God, and he said unto those who were with him: We will go down, for there is space there, and we will take of these materials, and we will make an earth whereon these may dwell; And we will prove them herewith, to see if they will do all things whatsoever the Lord their God shall command them; And they who keep their first estate shall be added upon; and they who keep not their first estate shall not have glory in the same kingdom with those who keep their first estate; and they who keep their second estate shall have glory added upon their heads for ever and ever. And the Lord said: Whom shall I send? And one answered like unto the Son of Man: Here am I, send me. And another answered and said: Here am I, send me. And the Lord said: I will send the first. And the second was angry, and kept not his first estate; and, at that day, many followed after him.

We are all quite familiar with this part of the story of the Grand Council. Once God had announced that He would send his Beloved and Chosen Firstborn to be his Only Begotten Son, each of us had the choice to accept or reject the plan. Satan did not give up easily. He initiated a War in Heaven in which he was able to draw away the third part of Heaven's host after him. The casting out of Satan and his host is described most poetically in Revelation 12:7 and 12:4: "And there was war in heaven: Michael and his angels fought against the dragon; and the dragon fought and his angels. ... And his tail drew the third part of the stars of heaven, and did cast them to the earth." This number is confirmed in modern revelation:<sup>7</sup> "the devil ... rebelled against me, saying, Give me thine honor, which is my power; and also a third part of the hosts of heaven turned he away from me because of their agency."

But what about the other half of the Great Plan of the Creator, which was presented in the Grand Council? Many Christians seem to believe that God was taken by surprise by Adam's disobedience in the Garden of Eden. Such belief flies in the face of the notion that God is omniscient. Not only was Adam and Eve's behavior in the Garden not a surprise to God, it was foreseen from the beginning as part of the plan presented to us in the Grand Council. Lehi, in his blessing to Jacob, taught:<sup>8</sup>

if Adam had not transgressed he would not have fallen, but he would have remained in the garden of Eden. And all things which were created must have remained in the same state in which they were after they were created; and they must have remained forever, and had no end. And they would have had no children; wherefore they would have remained in a state of innocence, having no joy, for they knew no misery; doing no good, for they knew no sin. But behold, all things have been done in the wisdom of him who knoweth all things. Adam fell that men might be; and men are, that they might have joy.

In accepting the great Plan of Salvation, we accepted both Adam's and Christ's part in the plan. Without a Fall there was no need of a Redemption: "as in Adam all die, even so in Christ shall all be made alive."<sup>9</sup> We are all partakers of the "flesh and blood" given us by Adam,<sup>9</sup> just as we are all partakers of Christ's redemption.<sup>10</sup> Paul stated in his letter to the Romans:<sup>11</sup>

Wherefore, as by one man sin entered into the world, and death by sin; and so death passed upon all men, for that all have sinned: (For until the law sin was in the world: but sin is not imputed when there is no law. Nevertheless death reigned from Adam to Moses, even over them that had not sinned after the similitude of Adam's transgression, who is the figure of him that was to come. But not as the offence, so also is the free gift. For if through the offence of one many be dead, much more the grace of God, and the gift by grace, which is by one man, Jesus Christ, hath abounded unto many. And not as it was by one that sinned, so is the gift: for the judgment was by one to condemnation, but the free gift is of many offences unto justification. For if by one man's offence death reigned by one; much more they which receive abundance of grace and of the gift of righteousness shall reign in life by one, Jesus Christ.) Therefore as by the offence of one judgment came upon all men to condemnation; even so by the righteousness of one the free gift came upon all men unto justification of life. For as by one man's disobedience many were made sinners, so by obedience of one shall many be made righteous. Moreover the law entered, that the offence might abound. But where sin abounded, grace did much more abound: That as sin hath reigned unto death, even so might grace reign through righteousness unto eternal life by Jesus Christ our Lord.

Jacob<sup>12</sup> described the infinite nature of the atonement:

For as death hath passed upon all men, to fulfil the merciful plan of the great Creator, there must needs be a power of resurrection, and the resurrection must needs come unto man by reason of the fall; and the fall came by reason of transgression; and because man became fallen they were cut off from the presence of the Lord. Wherefore, it must needs be an infinite atonement — save it should be an infinite atonement this corruption could not put on incorruption. Wherefore, the first judgment which came upon man must needs have remained to an endless duration. And if so, this flesh must have lain down to rot and to crumble to its mother earth, to rise no more. O the wisdom of God, his mercy and grace! For behold, if the flesh should rise no more our spirits must become subject to that angel who fell from before the presence of the Eternal God, and became the devil, to rise no more. And our spirits must have become like unto him, and we become devils, angels to a devil, to be shut out from the presence of our God, and to remain with the father of lies, in misery, like unto himself; yea, to that being who beguiled our first parents, who transformeth himself nigh unto an angel of light, and stirreth up the children of men unto secret combinations of murder and all manner of secret works of darkness. O how great the goodness of our God, who prepareth a way for our escape from the grasp of this awful monster; yea, that monster, death and hell, which I call the death of the body, and also the death of the spirit. And because of the way of deliverance of our God, the Holy One of Israel, this death, of which I have spoken, which is the temporal, shall deliver up its dead; which death is the grave. And this death of which I have spoken, which is the spiritual death, shall deliver up its dead; which spiritual death is hell; wherefore, death and hell must deliver up their dead, and hell must deliver up its captive spirits, and the grave must deliver up its captive bodies, and the bodies and the spirits of men will be restored one to the other; and it is by the power of the resurrection of the Holy One of Israel. O how great the plan of our God! For on the other hand, the paradise of God must deliver up the spirits of the righteous,



*Saint Peter and Saint John Run to the Sepulchre*, 1886-1894, J. James Tissot (1836-1902)

and the grave deliver up the body of the righteous; and the spirit and the body is restored to itself again, and all men become incorruptible, and immortal, and they are living souls, having a perfect knowledge like unto us in the flesh, save it be that our knowledge shall be perfect.

Jacob stated, first, that “death hath passed upon all men, to fulfil the merciful plan of the great Creator,” and, second, that “the resurrection must needs come unto man by reason of the fall;”<sup>13</sup> third, the Atonement, “must needs be an infinite atonement.”<sup>14</sup> Had it not been infinite, “the first judgment which came upon man must needs have remained to an endless duration.”<sup>15</sup> Fourth, “the bodies and the spirits of men will

be restored one to the other; and it is by the power of the resurrection of the Holy One of Israel ... and all men become incorruptible, and immortal, and they are living souls, having a perfect knowledge like unto us in the flesh, save it be that our knowledge shall be perfect.”<sup>16</sup> In the previous two paragraphs, the parallel between the fall and the atonement has been emphasized by the scriptures, “... as in Adam all die, even so in Christ shall all be made alive.”<sup>17</sup> Jacob<sup>18</sup> pointed out that the atonement was an infinite atonement affecting *all* men. He also stated that the Fall passed upon *all* men. It seems reasonable to also call the Fall an *infinite* Fall.

It is clear that the Atonement and resurrection did not just affect those born after the death and resurrection of Jesus Christ. Indeed, at the time of Christ’s resurrection, we know that “the graves were opened; and many bodies of the saints which slept arose.”<sup>19</sup> Therefore, the resurrection was infinite, not only in affecting all humans who would live afterward, but all those born before Christ’s resurrection. The resurrection was both anticipatory and retroactive.

What about the Fall of Adam and Eve? Is it possible that the Fall was also both anticipatory and retroactive? In other words, could it be the case that not only those who lived after Adam and Eve but also that there were many who lived *before* Adam and Eve who partook of the Fall as well as the Atonement?

We are told “that this is the man who receiveth salvation, through the atonement which was prepared from the foundation of the world for all mankind, which ever were since the fall of Adam, or who are, or who ever shall be, even unto the end of the world.”<sup>20</sup> We are also informed that death fulfilled “the merciful plan of the great Creator.”<sup>21</sup> Adam was Michael, who led the heavenly hosts against Satan and his hosts.<sup>22</sup> He was given the title prince, archangel,<sup>23</sup> the father of all, the prince of all, the ancient of days.<sup>24</sup> Adam was told by God that “I have set thee to be at the head; a multitude of nations shall come of thee, and thou art a prince over them forever.”<sup>25</sup> Adam was “called and prepared from the foundation of the world.”<sup>26</sup> Adam was also not just a name but also a title, “Male and female created he them; and blessed them, and called their name Adam, in the day when they were created.”<sup>27</sup> Adam had the right of the High Priesthood, “he right of the firstborn, or the first man, who is Adam, or first father” from before the foundation of the earth.<sup>28</sup> Adam presided over the first patriarchal generation, “in the days of the first patriarchal reign, even in the reign of Adam.”<sup>29</sup> Adam also was called the “first flesh.”<sup>30</sup> Eve was also a title as well as a name: “And Adam called his wife’s name Eve, because she was the mother of all living; for thus have I, the Lord God, called the first of all women, which are many.”<sup>31</sup>

We call Adam the “first man.”<sup>32</sup> This term has always been used as a statement of Adam’s position in the line of humanity, and recognizes him as “the first man of what we would call the human race.”<sup>33</sup> But I still wonder whether “first man” could be viewed as a title instead. In Moses 3:7, Adam was also called the “first flesh,” yet the same verse also says that man was made “from the dust of the ground,” which we understand to be figurative. Just as Christ was chosen in the Council in Heaven to be the “firstfruits”<sup>34</sup> of the resurrection, so was Adam chosen in the same council to be the “first man.” He represents all humanity in the Fall, which perhaps, like the Atonement, might be both anticipatory and retroactive. We are told in Mosiah 3:11, 16:

For behold, and also his blood atoneth for the sins of those who have fallen by the transgression of Adam, who have died not knowing the will of God concerning them, or who have ignorantly sinned. And even if it were possible that little children could sin they could not be saved; but I say unto you they are blessed; for behold, as in Adam, or by nature, they fall, even so the blood of Christ atoneth for their sins.

We are sure that the blessings of the Atonement extend to countless people who were born before and after the time of Jesus Christ, who never heard His name. It is my hope and belief that God will extend as many blessings as is possible to the prehistoric individuals born before Adam, who never heard of Adam during their mortal lives — those who with such great care and talent painted the walls of Chauvet Cave some 35,000 years ago — those from ancient times who are loved by the same Lord and Creator of all.

**Endnotes**

- 1, Genesis 4:2.
- 2, Jeremiah 1:5; Acts 17:28; Romans 8:29; Ephesians 1:4; Hebrews 12:9; Alma 13:3; Helaman 14:17; D&C 38:1; 49:17; 93:29; 138:56; Moses 3:5; 6:36; Abraham 3:22-23; 5:7.
3. 2 Nephi 9:13.
4. Job 38:7.
5. Moses 4:1.
6. Moses 4:2, 4.
7. D&C 29:36.
8. 2 Nephi 2:22-25.
9. 1 Corinthians 15:22.
10. Hebrews 3:14.
11. Romans 5:12-21.
12. 2 Nephi 9:6-13.
13. 2 Nephi 9:6.
14. 2 Nephi 9:7.
15. 2 Nephi 9:7.
16. 2 Nephi 9:12-13.
17. 1 Corinthians 15:22.
18. 2 Nephi 9:6.
19. Matthew 27: 52.
20. Mosiah 4:7. See also Alma 12:33 and 22:13.
21. 2 Nephi 9:6.
22. D&C 107:54.
23. D&C 107:54.
24. D&C 27:11.
25. D&C 107:54.

26. Alma 13:3.
27. Genesis 5:2. See also Moses 6:9.
28. Abraham 1:3.
29. Abraham 1:26.
30. Moses 3:7.
31. Moses 4:26.
32. Moses 1:34; 3:7; Abraham 1:3.
33. President Gordon B. Hinckley, 2002, cited in Larry A. Witham, *Where Darwin Meets the Bible: Creationists and Evolutionists in America*. New York City, NY: Oxford University Press, 2002, p. 177.
34. 1 Corinthians 15:20, 23.



# LIFE SCIENCES PANEL

Emily Bates, R. Paul Evans, Steven L. Peck,  
Michael R. Stark, Trent D. Stephens



Left to right: Trent Stephens, Steve Peck, Paul Evans, Emily Bates, and Michael Stark

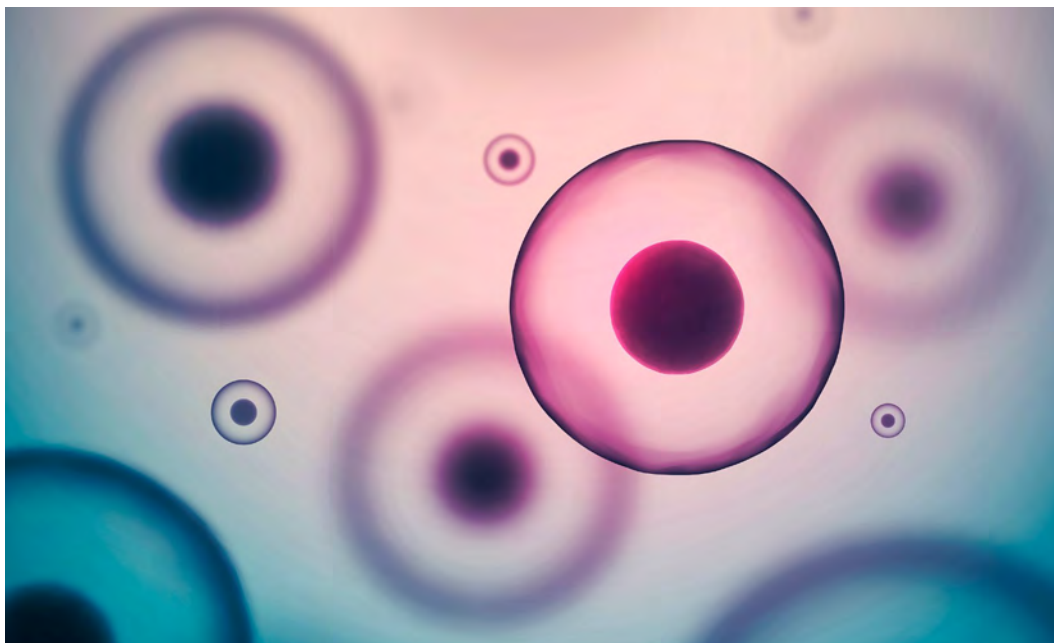
## **Michael Stark:**

After each of you have a chance to give some introductory thoughts, we will address a few questions that have been written down. Also, we'd be happy to field any questions that anyone in the audience wants to ask.

I'll start by introducing myself. My name is Michael Stark, and I've been a faculty member at Brigham Young University since 2001. I'm in the department of physiology and developmental biology, and my background and training is primarily in cell and developmental biology.

An important part of my training came after I left Brigham Young University with a bachelor's degree in zoology. I had the privilege being mentored in research by Trent Stephens at Idaho State University, who is with us today on the panel. Trent was influential in my life, helping me to think about science in the right way and to ask interesting and important questions. After I studied with him for a couple of years, I received my PhD from UC Irvine and spent some time at Cal Tech. My main focus was studying the early development of the nervous system.

My scientific interests center on understanding what we call cell fate determination, or how different molecular and genetic programs assemble



*Stem Cells*

themselves in cells to push that cell toward a certain fate or a certain decision, such as becoming a neuron or becoming a muscle cell. A lot of my focus has been on understanding early nervous system development and how cells make those fate choices. I've dabbled in stem cell biology, asking questions about the molecular programs that help push stem cells toward certain fates. It's really been a fruitful and exciting career and experience for me.

I want to emphasize that as I've gone through my career, I frequently reflect back — probably on a daily basis — to the important things of my life, such as family and the gospel of Jesus Christ and how I can be a better follower of Christ. Connecting those things to my work in science is a little bit difficult, as any of these panelists would attest. Each of us has gone through different stages in our levels of understanding of biology and biological principles — how they apply to us, and how we can bring the knowledge that we obtain through science in harmony with what we believe spiritually and the teachings of the Church. There are a couple of important experiences in my life that have helped me sort through this process.

I remember being challenged as a young teenager with the idea that there was a conflict between science and religion in the age of the earth. I was asked as part of a physics class to debate my classmates, and each of us drew straws as to whether we would be on the side of the debate of a very old earth, millions or billions of years old as science teaches us, versus a young earth, just a few thousand years old as some people think the Bible is describing. That was the first time I had the opportunity to seriously wonder about truth and how we obtain it. One gift I've been privileged to obtain is to *know* that any truth we learn from any source here on earth comes from our Heavenly Father. He reveals it to righteous and unrighteous people alike

through scientific discovery, investigation, revelation, or however He sees fit. I'm grateful for that.

I'm grateful to have been part of the process in discovering some things that were not known before. Being part of that process inspires me and directs me to understand God's divine nature. It also gives me an opportunity to teach the students at BYU and others about the great opportunities we have to expand our minds and to prayerfully understand and consider the knowledge we can obtain directly through personal revelation — as well as through hard work, research, and scientific discovery. Those are the basic principles that govern my employment, my career, my scientific inquisitiveness, and also the way I try to live the gospel of Jesus Christ.

As we interact today, some questions may involve things that are in my area of expertise such as stem cell biology, early embryonic development, and gene expression — and how these things govern cell fate choices and developmental models. Now, however, the other panelists will describe their own personal background and expertise so that we can address your questions appropriately. Thank you.

**Emily Bates:**

I'm Emily Bates, and my first conflict between scientific inquiry and my religion occurred here in Provo, Utah. I was in school when I started learning about evolution. At the time, my Sunday School teacher had taught me that you could not believe in the teachings of The Church Jesus Christ of Latter-day Saints and also believe in evolution. I remember learning about evolution in school and thinking it made a lot of sense. There was a lot of evidence for it. So I started praying for a way to see what was wrong with this theory, so I could go on with having my faith in my Church. It was a long time before I felt I had any response. One night I woke up in the middle of the night, and I had this impression that I should read Genesis. I did that and I had this feeling and recognition that there was no conflict. I could see the order of evolution described in the scriptures. That was my first answer to prayer. It became both my testimony of God and my testimony of science at the same time.

I decided to go into science as a career because of my patriarchal blessing. I enrolled at the University of Utah, where I started working in a lab before my freshman year. As an undergraduate, I helped to publish a study about drosophila genetics. After I graduated, I went on to Harvard Medical School, where I did my PhD studying the molecular mechanism of Huntington's Disease, which is a genetic neurological disorder. My work identified potential therapeutic targets for that disorder. From there I went to University of California San Francisco School of Medicine (UCSF), and there I studied the genetics of migraines. They had a short piece about our research on National Public Radio (NPR) in May. Then I came back to Brigham Young University. For four and a half years I taught undergraduates and continued my research on migraines and genetic birth defects. I enjoyed teaching the wonderful students at BYU. I have now taken a position at the University of

Colorado Denver School of Medicine, where I have been given additional opportunities to push my research forward. I'm continuing to study syndromes of birth defects and genetic causes of different disorders. I love science; I also have faith, and I don't see a conflict between them.

**Paul Evans:**

I'm R. Paul Evans. Several years ago I was walking along 9th Avenue in New York City while visiting my daughter and son-in-law. We walked past the Church of Saint Paul the Apostle — that's just a few blocks away from the Lincoln Center — and they had an announcement for a book discussion that evening on early Christianity. "Well I'm gonna go to that. It looks really interesting," I thought. The author was there, outlining the thoughts of the early Christian Fathers on various theological matters. At the end there was a question and answer period, and one of the questions was, "What about the Mormons and their claim on certain ideas in early Christianity?"

The author of the book, who's a professor at a Midwestern school, thought for a second and said, "There are no new heresies." He went on to explain that all the ideas about early Christianity that our Church has brought forward were the same sorts of ideas present in the writings of some of the early Fathers that were later pruned off as Christianity reached a consensus on theology. So I think the same way when I read the ideas of the "new atheism." I think, "Well, it's not new. It's the same sort of ideas — maybe the volume is a little larger, maybe the platform is a little bit more open, but the ideas are the same." I also think in a similar way about issues of science versus religion. I reflect upon early thinkers like Socrates and his ideas about how to go forth in life, and the conflicts he had with the surrounding culture at the time. Nothing major has changed.

We're always conflicted in our discussions of what is truth and what is not, what can direct a life and what can't. As a scientist I started as an undergraduate at BYU. Then I went on to graduate school at the Medical College of Virginia — it's in Richmond, that's home for me, the Washington, DC area — and studied antibacterial resistance in bacteria. In particular, I studied the bacteria that caused tooth decay, hoping to make a vaccine against tooth decay. It didn't work. The antibodies against the bacteria that cause tooth decay also worked very effectively against heart muscle, so that didn't turn out to be a good thing.

In science you have some really great ideas, but not all of them result in the outcomes we would have wished. But it was an interesting avenue to explore. From there I went to Purdue University as a post-doctoral fellow and worked on the genes responsible for seed protein, protein type, and content in soybean seeds and manipulating those and changing those and introducing a more complete protein source into soybeans.

Since coming to BYU in 1987, I have been involved in looking at DNA sequences of populations — how they change over time, what it is that identifies individuals and



*DNA Fingerprinting*

populations, and how can those be reflected in geological events, in transmission events, and mutation over time. That's involved a lot of fish — especially cutthroat trout — all sorts of aquatic insects, snakes, and other creatures. I went to Egypt as a part of the BYU Egypt excavation [[www.facebook.com/ByuInEgypt](http://www.facebook.com/ByuInEgypt)], where we've been looking at the DNA sequences and the biology of people of 2,000 years ago.

The idea is that if we could understand what a human population looked like 2,000 years ago — or now even with Neanderthals, you know fifty and sixty thousand years ago — we might be able to say some interesting things about the human condition today. That's where I've come from, but my life is hypothesis driven. I perform experiments that involve techniques like polymerase chain reaction. I have some ideas on how that works, and I perform the experiment with the idea that I will have a particular outcome. Experiments don't always work, and so you do it again, and you try to figure out what was wrong.

I have hypotheses about southern blot; I have hypotheses about DNA sequencing. I act on those ideas, and perform those experiments. The results are usually as expected, but there are always times where surprises happen. Surprises and failures in experiments don't stop me from trying because there's enough evidence from what I've seen, from authorities, and from what I have personally experienced that tells me where there is something I need to change in order to make the experiment work. I have the same idea about faith and prayer. Sometimes I have an idea of what I think faith is, and what I think prayer is, and what I think my relationship with my Savior is. I test the hypothesis, I act a particular way, and it doesn't always turn out the way that I thought it was going to be.

That doesn't change the reality of the presence of my Savior and my Heavenly Father. What it means is my understanding of how they do their work and what

my relationship is needs to change. So testing hypotheses, moving forward in a given direction, is not only how I operate on a scientific basis, it's also how I live on an everyday basis. This way of moving forward works for me: "Oh, that didn't work, I guess I'll have to change."

One of my favorite cartoons, which I have posted outside my office, shows a machine. Somebody walks up to the machine and pushes the button, and they get zapped by lightning. They're charred, standing there smoldering, then the cartoon splits. The top half is titled "Ordinary People" — the caption below the cartoon character says, "I'm not going to do that again." And the bottom panel is titled "The Scientist" — and the caption says, "I wonder if that's reproducible?"

### **Steven Peck:**

I'm Steve Peck. I'm in the Biology department at Brigham Young University. How I got there is a surprising journey of faith and discovery.

I was in the Army, serving in Germany — we used to do these long maneuvers for several weeks at a time — and I drove an ammo carrier, which meant that I had to park far away from everybody. So I had a lot of time to be by myself. I spent much of the time pondering about what I should do with my life (because driving an ammo carrier didn't really seem like a long-term solution (no offense to ammo carrier drivers in the audience); I wanted something different. So I used this time "in the wilderness" trying to figure out what I wanted to do. I spent a great deal of time fasting and praying about the question.

During that time, I had a very clear revelation that I should become a teacher. From that time on that was my goal. I got out of the Army and went on a mission to Arkansas — I never really learned the language but I learned enough to get by. I came to BYU after. I've always been interested in evolution — whether I believed in it or didn't. When I arrived at BYU, I had come from reading things like Joseph Fielding Smith's *Man, His Origin and Destiny*, which, as you know, speaks out very clearly against evolution. A friend told me he was taking a class in evolution, so I went to the BYU Bookstore and found the book they were using for the evolution class, and was surprised to see it was an ordinary evolutionary biology textbook like you'd find at any other university. It was not the take down proof that evolution was wrong that I had expected. I thought, "It looks like a straight up account of regular evolution." I expected the evolution book at BYU to say evolution is obviously false and flawed, and so this intensified my curiosity about it.

I decided to major in biology, and that lasted for about a year and a half until my wife and I were in a wreck on our honeymoon, which made me think, "Well, maybe I should do something a little more marketable," so I majored in statistics with a minor in zoology. That launched me into biology from a computational perspective. I did my doctorate at North Carolina State in bio-mathematics, which

is mathematics applied to biology. Finally I came to BYU to teach and do research in the Biology Department.

On my mission I remember an experience in which I told somebody they couldn't be baptized until they gave up their belief in evolution — this is how clear the issue of evolution and the Church was to me at the time. Then I came to BYU and took classes and was presented with the data and became convinced that it was true. Speaking of Carl Sagan, whom we've applauded today, at the time I was also watching *Cosmos* and David Attenborough's show *Life on Earth*. Watching these popular programs I was completely overwhelmed with the beauty and evidence of evolution. Luckily for me, at BYU I had teachers who were at the same time faithful members of the Church and also taught evolution. I had four high school friends at other universities, and when they were presented with the evidence for evolution, they honestly believed, like I did, that there was no place for both in the Church.

So for me, this became a sort of crusade to help people who were struggling with their faith because of evolution. I wanted to help them come to terms with it, to recognize that you don't have to give up one to hold on to the other.

For me this has been an amazing and fun journey. If I have one overriding fundamental attribute, it's immense curiosity. I don't have all the answers, but I love probing things of all sorts. It gets me in trouble more often than not, but so be it. That's why I think symposia like this one are so important. I think it's very important that we get together and discuss our faith and our science, and how they work together. There are tensions. I admit that there are places where I don't have answers to how it works or why it works — but for me, I can imagine possible solutions for some of the issues that suggests to me there are yet other solutions that I haven't yet explored. Although I might not have hit upon the right ideas yet, I know enough to be able to keep hold of my faith in the hope that the tensions I see will get worked out in a satisfying way. And for me, I just love this. I have fun.

Yeah, I love science. I love my faith, and I'm glad that I can speak about it in places like this one — and express my belief that science and religion fit together well.

**Trent Stephens:**

My name is Trent Stephens. I'm an emeritus professor of anatomy and embryology at Idaho State University. I grew up in southern Idaho on a dairy farm. That's why I'm here. I'd rather be anywhere than a dairy farm. How many of you are familiar with Malta, Idaho?

Oh wow, a lot of you have been to Mecca, population 200. I grew up in a suburb. I've always had two thoughts in mind: one is an enormous curiosity, which I guess this panel seems to have in common, and the other is a belief that all truth is compatible, and so I've never had any problem seeking for truth and knowledge, no matter where it lies.

When I graduated from the eighth grade (in Malta, if you can imagine, there's only a grade school and a high school — not enough people for a middle school), I asked for a graduation present of a book entitled *Chromosome Numbers in Animals*. I went through the book cover to cover. There's no text in the book. There's no narrative. It is about a three-hundred page book of just tables. I decided that this was the key to disproving evolution that everyone else before had somehow missed out on. I decided that if there's a progression of evolution from less specialized and less highly developed organisms to more specialized and more highly developed organisms then that transition should be reflected in the chromosome numbers of animals. So I plotted all of these tables in a big chart that I created on a poster board. I found that there is no pattern to the chromosome numbers between closely related animals. And I thought, "Ah-ha! Finally someone has come up with a definitive argument against evolution." Unlike Steve, I didn't go quite as far as my mission in carrying that notion around in my head, but I was convinced at the time that evolution was incorrect.

The entire hominid fossil record could be fit into a shoebox in the mid-1960s, and half of the fossils were fakes. At that time when you looked at something like the Piltdown Man, everyone knew that it had been shown to be a fake. I thought, "Well, you know that stands to reason." When I signed up for BYU, I declared my major as biochemistry and my minor as art. When I got here at BYU, I found out I was a chemistry major, and that art was nowhere on the curriculum. There was no biochemistry undergraduate program at BYU in 1966 when I arrived here, so I decided, "Hey, what better time to disprove evolution than in my freshman year at BYU?"

I started to writing a thesis about the chromosome barrier to evolution. I went to the library, started doing research, and immediately came across Carson's work with Hawaiian drosophila in which he demonstrated very elegantly that you could see these chromosome inversions that mapped the exact evolutionary pattern of drosophila in the Hawaiian islands. I thought, "Wow, have I been wrong!"

I realized there was an enormous amount of evidence, and the more I looked, the more I found. At that time chromosome patterning and molecular biology, which is what I really wanted to go into, didn't even have a name yet — and the more I learned, the more I found there is an enormous body of scientific evidence to support evolution.

I ended up going on a mission for two years to Michigan and Indiana, then came back. I didn't like chemistry; it was the bio part I liked, so while I was working on construction the summer after I came back from my mission, I heard on the radio that the first gene had been isolated from *E. Coli*, and I realized that was a bacterium — I came back and changed my major from chemistry to microbiology. I spent most of my time in the zoology department, and particularly in Fanny Farkle's Fantastic Fly Factory.



*E Coli Bacteria*

Duane Jeffery had a great influence on my life as an undergraduate. When I finished, I had enough zoology credits that I graduated with a double major in microbiology and zoology. In the process I became very interested in the whole idea of shape and how biological form occurs. That came about in 1971 at the same time I was enrolled in the very first evolution course ever taught at BYU.

There was a big controversy in 1911, and a lot of it was focused on the Brigham Young Academy. The academy became a university in 1903 and had hired new teachers to raise the curriculum to a university level. President Joseph F. Smith made a statement in the *Juvenile Instructor* that “until we receive more light upon the subject [of evolution] we deem it best to refrain from the discussion of certain philosophical theories. ... Some of our teachers are anxious to explain how much of the theory of evolution, in their judgment, is true, and what is false, but that only leaves their students in an unsettled frame of mind.” And this is what I think is interesting: he didn’t have a very high opinion of Brigham Young Academy [University] students. He said, “They are not old enough and learned enough to discriminate, or put proper limitations upon a theory which we believe is more or less a fallacy. ... [E]volution would be best left out of discussions in our Church schools.” And it was left out for the next sixty years.

“The Church itself has no philosophy about the *modus operandi* employed by the Lord in His creation of the world.” He went on to say, “It is much preferred that they (the institutions of learning) emphasize the industrial and practical side of education. ... If our Church schools would confine their so-called course of study in biology to that knowledge of the insect world which would help us to eradicate the pests that threaten the destruction of our crops and our fruit, such instruction would answer much better the aims of the Church school, than theories which deal with the origin of life.” I find it very interesting that he talks about insect pests, because the best way for us to really understand insect pests properly is to understand their evolution and their resistance to pesticides.

So for sixty years, evolution was not taught in the Church schools — until 1971, when Duane Jeffery and Clayton White taught a course together on evolution. I was one of the students in that course. I should mention that Duane, about the same time, gave a lecture on this very intriguing little marine plant called *Asotabelaria mediterranea*. This tiny plant is about two to three inches tall and has one nucleus. It’s a single-celled plant that has a nucleus big enough to see without using a microscope. It’s incredible. One variety of the plant looks like a little

umbrella, and another variety of the plant looks like a little mace. One is called *Asotabelaria mediterranea*, and the other one's called *Asotabelaria crenadia*. I became so fascinated by the shape of this little plant that I decided the focus of my career would be to understand biological form.

After finishing my undergraduate degree in zoology, I stayed on at BYU for one more year and got a master's degree with Bob Seegmiller, again in zoology. Then I went to the University of Pennsylvania to work with Dr. James Lash in looking at the issue of development of the limbs. For many, many years, my research has been looking at the question of why limbs are located where they're located on the body — how do they form developmentally. At the same time, I also became fascinated with the question of how thalidomide causes birth defects. So I've had something like two parallel career paths. After receiving a Ph.D. at the University of Pennsylvania, I went to the University of Washington for a postdoc in pediatrics. I was specifically interested in studying the range of human birth defects. Then, in 1981, I was hired at Idaho State University (ISU) to teach in their new dental school, to teach anatomy and human developmental biology. I retired from there in 2011.

While I was at ISU, I had a student in the Biology department named Forrest Peterson who was a theater major. He went to the department chairman and complained about the teaching of evolution in the zoology classes. Forrest was LDS, so the department chairman sent him to me, and I spent about two and a half hours explaining to him the beauties of evolution and how it was not incompatible with our theology.

When we finished — this was about twenty years ago — he said, "Well, now that you've told me all this, what book can you advise me to read on this subject?" I said, "There aren't any that have been written since about the early 1960s." And he said, "Well, why don't you write one?" I said, "Well, I've been thinking about it for a long time." About that time, another LDS faculty member named Jeff Meldrum joined our faculty. Jeff and I set out on a project to write a book entitled *Evolution and Mormonism*, which we published about twelve years ago. Later, we decided we needed to write another book on the topic of DNA data and Native American origins, which was published a few years later with the title *Who Are the Children of Lehi?*

About the same time, I was asked by the *Journal of Mormon History* to review a book published by Dwayne Anderson titled *Farewell to Eden*. In the introduction to his book, Anderson said that he had some questions — he has a master's degree in physics from BYU and lives in Arizona. When he went to his bishop about his questions, the bishop said, "Don't worry about them." That was not very satisfactory to Dwayne.

He went to his stake president with the same questions, and was told, "Don't worry about it." Reading about Anderson's experience really killed me. I've been a bishop twice, and I recognized that he had a real issue. If he had gone to his



*Identical Sheep*

bishop with a financial problem, the Church has formal, professional help for that. If he had gone to his bishop with a psychological problem, the Church has formal, professional help for that. In the *Handbook of Instructions*, it tells the bishop what to do. If a person goes to a bishop and has a problem of faith, there's nothing in the *Handbook* telling the bishop what to do. So I'm very, very interested and anxious to help any way I can, particularly in speaking with bishops and young people who are faced with perceived problems with any aspect of the teachings of the Church, including science and evolution.

**Michael Stark:**

Thanks to each one on the panel for your introductions. We have a handful of questions to start with, and each panelist has one or two questions already in front of them. I'll start with one that came up in a prior session. The same question was stated different ways. This version says, "Is cloning ethical, approved by God? At what point does cloning go too far?"

It's an interesting question; I get this from students at BYU on occasion. In our scientific advancement, we biologists have have been able to clone many organisms, and the question of ethics when it has to do with animals doesn't bother us too much, I suppose. However, I've never met a biologist who doesn't believe there are serious bioethical problems with attempts at cloning humans — meaning cloning for reproduction, creating a new human through the process of cloning.

The process of cloning involves taking DNA from a somatic (i.e., body) cell from an adult organism and transplanting that DNA into an egg that's been enucleated,



*Identical Twins*

then allowing it to develop. In theory, the technology to clone a human is available. I have heard no reports that it's ever been done. There's no easy answer, but when students ask me this question, I challenge them to think about how they would define cloning and how one would define a clone in biological terms.

Emily just mentioned one of the most common answers to the question of what is a clone — and probably a pretty correct one: It's an organism that is genetically identical to another individual. Do we have any examples of genetically identical individuals in this world? And the answer is identical twins, right? Or triplets, right? Yes. Anything else, Paul? Quadruplets, quintuplets. Any human parent of multiple births knows that the spirit of each child is different.

Emily — we'll just go down the row — what questions do you have?

### **Emily Bates:**

This question states, "Do chemicals in [the] brain determine how we act versus God and/or agency?" This, I think, is mostly a question about what's going on in our brains, and what is predetermined versus what we can choose. There's a little bit of both, I would say.

Our genetic makeup determines to some degree what is in our brains. For example, our susceptibility to depression, our susceptibility to mental illness, maybe even our tempers can be somewhat determined by our genetic makeup. That said, we also have ways in which we can modify what's in our brains.

For instance, if you repeat a behavior many, many times, the connections between the neurons that make that process become strengthened, and it becomes easier to do that act. For instance, when you practice a violin, after a while you don't really have to think about playing a sequence of notes in a particular order — it just happens without thought. That happens because those neural circuits are practiced and strengthened, and you can modify how your brain will behave by practicing and by habit.

But because we're different genetically, we all have different tools we're working with, so we all have different struggles, susceptibilities, and different capacities as well. Things that are easy for one person may not be as easy for someone else. Each of us has agency, and each of us also has some susceptibilities or predetermined tendencies. That's why we're not supposed to judge anyone, because we don't know what they're up against — and they don't know what we're up against. I think that's why we have to leave that to God. God knows what I'm up against, and He knows what you're up against. We must do the best we can with what we have. We shouldn't feel guilty if we have a susceptibility to depression, for example, and we shouldn't feel guilty for needing treatment for depression. But we can modify our strengths by practicing good habits.

We have agency, within the sphere we've been given. We can do the best we can with the package we've got, right? That has to do with the second question, so I'll tie those together.

The second question is about sexual preference and agency. I have known Mormon men who had same-sex attraction and didn't want that life style. They wanted to have a family with a female wife, and they wanted children. They struggled because although they could choose their behavior just as I could, they couldn't choose not to be attracted to men anymore.

Sexual proclivities like this have been shown biologically as well. You can mutate one gene in a fruit fly, and the male will try to mate with other males. In mice, the part of the brain that is responsible for attraction has been identified. There are pesticides such as Atrazine that feminizes male frogs and induces the same enzymes in mammals. Exposure to pesticides during development is not a child's choice. Atrazine usage is really prevalent in the United States, but it's outlawed in much of Europe. I don't know the cause of same-sex attraction. I'm certainly not one that can judge. We're not allowed to judge anyone other than ourselves, so I leave it at that. I think we all have agency to do the best we can with the biological package we're given, but all of us have a different package, so we can't judge each other.

**Paul Evans:**

My question has to do with thoughts and how they would affect our gene expression, and it's prefaced by the idea of epigenetics. So if you think about the genetic information you have that determines how your cells behave — that is, what information is available that can direct cellular function and outcomes, that would be our DNA sequence, and that's what's inherited, but you can modify the DNA, and that modification of the DNA can result in different types of expression you would not expect to see just based on the DNA sequence. That's what we refer to as epigenetics — something else over and beyond genetics. You can modify it, you can organize the DNA, you can have it packaged in a different way, and that can be inherited from generation to generation.



So the question is, “Can thoughts affect genetic expression?” If I break it down, you would say, “Can my neuronal activity” — and that is, the activity of my brain and what’s going on in there — “can that change how the DNA is organized, how it’s modified, the DNA sequence itself, what gets expressed, what information gets played, if you will, on the piano if all the keys are there, what the score is of the piano piece that will be used?”

There’s no evidence, one way or another, on that question in terms of just brain thinking — neuronal activity — directly changing the gene expression pattern of a particular gene. Now the question comes, as Emily suggested, “How about acting on those thoughts and the behavioral result? Can you strengthen particular neuronal connections and result in it being easier to behave or to think in a particular way?”

That’s one of the ones where you say, “Well, maybe,” but again, the question becomes, from at least a scientific approach, how to measure that, and I’m just not aware of anything that would directly get at what would need to be measured. So, the susceptibility, if you will, to our genetics or even our epigenetics is not only things that we find to be out of the ordinary, but they can also be changes or susceptibilities that would increase our likelihood of particular activities we think would be positive. Whether we see or not is due to our genetic expression. Whether we hear or not is due to our gene expression and the genes that we have. Whether we think a particular way or not also seems to be influenced by our genetic heritage, how those genes are put together, and what other modifications the environment can impose, in terms of what we eat, where we are, what we breathe — all those can have impacts.

#### **Steven Peck:**

This question is directed straight to me. “Dr. Peck, I have to respectfully disagree with your assessment of the Discovery Institute. How do you explain the complex specified information, digital code contained in DNA, and other epigenetic information in the cell if you are restricted to a purely methodological, materialistic explanation?”

This is a really good question. One of the puzzles we have in science is the origin of DNA. There is some evidence that it started with RNA, but we don’t know. We don’t know, and this is on top of another puzzle that’s generating a lot of interest in the philosophy of science. In fact, a new book just came out this month entitled *Complexity and the Arrow of Time*. In fact, I’ve got a copy in my bag.

As we look at life on earth, we see it moves from very simple to much more complex. This arrow of complexity is very clear. People tend to ignore it. You find people like Stephen Jay Gould, who wrote a lot about evolution, who kind of hemmed and hawed and said, “Well, we don’t know if there’s an arrow of complexity; we can’t say — maybe things were as complex back then.” But there is a very clear signal. The stromatolites that we see, blue-green algae that looks like it was one of the very first



*James Watson and Francis Crick with a DNA Model*

forms of life on earth, are much simpler than, say, a rutabaga.

So this is an interesting question because it gets at the heart of one of the things about science: namely, that we don't have answers to some things. We don't have clear information about what the chemical world was like when the earth was formed, or how the process of life got started. Once we get natural selection going, evolution can take off, and then it's easy to see where complexity comes

from. One of the things about evolution is that if you're in an open system like we have, with the sun pouring energy into our world, there's no theoretical reason why you can't move from simplicity to complexity. You know when you come to your kid's room, and it's in a state of complete entropy, it takes energy to turn it into an ordered state. But energy can do that — directed energy. Given that we don't know some things, the question is about how we can respond to this perplexity?

The Discovery Institute has gone through a series of supposed biological examples in which it claims, "This is too irreducibly complex to have been evolved." So the question comes over to science, and science says, "No, such a thing can evolve, and here's the mechanism." I showed you the slide with the bacterial flagellum evolving and how that has been worked out step-by-step as an evolutionary process. Now that these questions are being answered by science, the Discovery Institute has had to retreat to another kind of question, and they're now saying, "Ah, but you still don't know how DNA got started. It's information-rich. How did it happen?"

We can have two responses to such a question. One is to say, "This is a scientific puzzle, and we're going to work on it." The other response is to say — and this has been the Discovery Institute's approach, "Aha! Here's something you can't explain, therefore God must be the explanation." The trouble is that it's been for them, from their inception, that when science explains, they have to retreat — this is what people in the field call an explanation that relies on the "god of the gaps." As scientific explanations advance and start to fill existing gaps one by one, those who

take a “god of the gaps” approach keep retreating to a smaller and smaller domain that they claim for themselves because science has not yet explained it.

But, as I mentioned, the scientific response is, “Here’s a puzzle. Let’s see what we can do with it.” Just this month progress was made in looking at the way that certain clays align certain precursors to RNA molecules, and you see a sort of arrangement that looks like it’s got potential as an explanation for how life got started on earth. So the scientific approach is, “These kinds of puzzles” — and every scientist knows there are things we don’t know: the quote by Lord Kelvin was just wonderful — “physics has got all the questions answered.” No scientist would make that claim now. Now we’ve got gobs and gobs of things to work on.

But a claim like that of the Discovery Institute, that “this is too complex” and so we’re going to have to insert God in there, becomes very dangerous because that kind of a God keeps getting smaller and smaller as science progresses.

My God doesn’t get smaller and smaller as science progress. My God stays the same size whether science is making claims or not. On a podcast once I made the claim that how life got started on earth we may have pegged in ten years. I may have to reduce that to about five years if this clay stuff works out, but it’s an empirical question, a question for science to explore.

If at the end of time, when all the science is done, and we, like Hoyle, can say, “There is no scientific explanation for how life got started on earth,” we might turn to the “god of the gaps” approach, but we’re a way off from that time. For now, I would say that the Discovery Institute is setting itself up for failure and setting up people for a failure of faith if they hang it on the “god of the gaps.” That’s my answer.

### **Trent Stephens:**

Before I go to my question, I’d like to comment on what Steve was talking about and also Mike’s earlier comment. When you look the structure of DNA and this idea of this clay template, etc., that’s being looked at right now, it’s somewhat related to my own research and the papers I’ve published on the mechanism of action of the drug thalidomide.

Back in the late 1950s, a company, a very small company in West Germany called Chemie Grünenthal, which was a cosmetic company, decided they were going to make an antibiotic, so they simply took an amino acid mixture and heated it up. It turned out that two of the amino acids fused in such a way that they made it a flat plate. When you make a molecular model of that flat plate, and you take a model of DNA, that little, flat plate of thalidomide can slide right in between the stacking nucleotides of the DNA, and apparently just by hydrogen bonding and sliding in there, it blocks transcription of certain genes with certain promoter sequences. It turns out that these certain genes are critical for blood vessel formation. So to go back and talk about the simplicity of DNA, it’s a heck of a lot simpler than people



think it is. We think, “Well, it’s got all this information, it must be very complex — actually it only has four letters in its alphabet. One simple drug manufactured in the late 1950s can slide into the DNA, block transcription of genes responsible for making blood vessels, and end up with people born with no limbs at all — no arms and no legs. That’s pretty powerful, but it’s very, very simple.

And then, going back to what Mike was talking about with cloning and with twins, I’ve spent my career studying birth defects, and I love to go to the extreme in all cases. So he’s talking about identical twins and triplets and quadruplets. How about twins that aren’t completely twins? Like a person or people — the different “personalities” tells you that these are two people — with one body, two legs, two arms, and two heads. The two heads think differently, they act differently, just like the differences between two completely separate identical twins. And then you ask the question, how many spirits are we dealing with here? I have no answer to that question, but I think it’s really interesting to think about.

Here’s a question specifically directed to me: “In your book, *Evolution and Mormonism*, you make a case for something called ‘bounded randomness.’ Could you explain how this is different from Intelligent Design? Has the evidence changed in this?”

That really follows up on Steve’s discussion of the Discovery Institute and Intelligent Design, and some people have actually written that what composes bounded randomness in our book is just another way to talk about Intelligent Design. Let me say it is not the same at all. I’ll tell you a little bit about how I got there.

To answer this question, I will begin by saying that when I started as a post-doc at the University of Washington, it was like being in Camelot. For someone like me who is interested in human birth defects, this was Mecca, this was Camelot. Anybody who was anybody in birth defects in the 1970s was at the University of Washington. The luminaries were there, and every Friday we had a roundtable discussion of various birth defects, and it was just fabulous. Right after I arrived there, one of these luminaries — his name is David Smith. How many have ever heard of David Smith? More of you know Malta than know David Smith — so Dave gave a seminar on a new book he had just published called, *Recognizable Patterns in Human Deformations*. He had previously published a book called, *Recognizable Patterns in Human Malformations*, of which I had a copy of as an undergraduate and had read and absorbed, but this was a rather different approach.

First of all, when I met Dave, I thought, “Man, this guy is not very bright. He’s big, freckle-faced, red-haired” — reminded me of a Swedish farmer — “and he is coming off in this real weird proposal that if you have a baby — a fetus that’s developing — and it’s mal-positioned in the pelvis of the mother, its head becomes not malformed, but *deformed*. There’s no genetic problem, no molecular problems with the fetus, it’s perfectly normal — it’s being pushed by outside forces.” I had just

finished a PhD at the University of Pennsylvania focusing on molecular mechanisms of development that said no to this idea. I argued that this could not be true because all development has a molecular foundation to it. And Dave said, “If these are caused by outside forces, we should be able to correct them using outside forces.” So he showed how you could mold a little football helmet for this newborn baby and push the head very gently and correct this rather severe deformation.



*A Baby Girl with an Orthopedic Helmet*

I thought, “Wow, my mind has been changed!” The data, which is the basis of science, gave the evidence that this was indeed the case. And while Dave was giving this talk, he referred to a very, very important book in biology entitled *On Growth and Form*, published in the 1930s by D’Arcy Thompson. Since that time I’ve told my students that the most important book in biology that you’ll ever read — and you should read it immediately if you haven’t — is *The Origin of Species* by Charles Darwin, and I challenge you to find a scientifically invalid concept in that book. Beyond the science, as pure prose it’s elegant.

The second most important book in biology is called *On Growth and Form* by D’Arcy Thompson. Now, in this book D’Arcy Thompson says, “I am not degrading or denigrating genetics” — and I would add the words “or molecular biology” (molecular biology didn’t exist by that time) — but, he said, “we also need to look at physical forces on biological form.” He said that every leaf, every shell, every bone is sculpted by physical forces in addition to the genetic forces there. To me this became a very critical idea. Very few people have followed up on D’Arcy Thompson, but, in my opinion, in the 1930s he was way ahead of his time — and I think he’s still ahead of *our* time.

I decided I would take these concepts that D’Arcy Thompson proposed, and I would apply them to developmental biology. So I have spent a lot of my career looking at *non-genetic* forces in development. That’s where this concept of bounded randomness comes in. It relates to the concept of chaos theory and how that determines shape. If you think of chaos theory outside of *Jurassic Park*, which has a very poor explanation of it, and if you think of this sphere, you think of a domain called a strange attractor and, for a given phenomenon, everything that’s going to happen is within this sphere. One of the concepts of chaos theory is that any given point in this sphere is equally probable as any other point in this sphere, therefore,

this randomness concept. A lot of evolutionary biologists have looked at this concept and talked about evolution as being entirely stochastic, driven by molecular mechanisms, a matter of mutation, and so forth, and that's very true, so that fits inside this strange attractor domain. But because of the work of D'Arcy Thompson, and some works later published by François Jacob, who was a Nobel Laureate, I thought, "You know, everybody's focusing on what's going on in the center, but why do we have a boundary here? What creates the boundary, and how does that relate to biological form?"

So, just to give you a very simple example: a chicken lays an egg. Everybody knows what the shape of an egg is — it's "egg-shaped," right? But that's not the egg; that's just the coverings. The egg is what we refer to as the yolk. What shape is the yolk? It's a sphere. Why is it a sphere? Are there genes in the chicken for "sphericity"?



Why would there be? If you make an oil drop the size of that yolk and suspend it in water, it's a sphere. Physics takes care of it so you don't have to assign genes in a limited genome to make spherical eggs because the physics deals with that. So that's what I've been investigating for a number of years and called "bounded randomness." You have stochastic events inside of a strange attractor, yet you have bounded

that strange attractor in a way that limits the extent of what those variations can be. It's scientifically testable. One can conduct experiments to test it. It is *not* Intelligent Design; it's almost the antithesis of Intelligent Design.

One experiment I conducted, looking at this issue, is that if you start out with the concept of a sphere, and you think of a salamander embryo as basically a pipe draped over the sphere, it turns out that the legs — I mentioned here that I'm interested in how arms and legs form — the four legs occur where the pipe ends on the sphere, so I thought, that's really interesting from a physics perspective. I wondered, "Could I tweak this system in any way?" What I found was that if I went in with a very young salamander embryo, and cut a little slit to separate the body axis, which is the tube, away from the sphere, that the hind legs no longer form where the yolk and body axis came together, but they now form where the new body axis and yolk attachment are. Up to six whole vertebrae more cranial, so I can take a salamander that normally has twelve dorsal vertebrae and make a salamander with only six dorsal vertebrae by simply making a slit in the embryo. This suggests that there are physical factors affecting shape in addition to genetic factors. So there is predictability in this random genetic milieu. So what's really interesting in looking

at strange attractors is asking, “what’s the boundary?” rather than “What’s going on inside?”

**Michael Stark:**

There’s a set of questions we’ve been answering throughout the day, and this relates to historical statements made by General Authorities related to science and religion and evolution. Does anyone on the panel want to comment on this?

**Emily Bates:**

I’ll just be really brief and say that just because evolution challenged the testimony of someone in authority doesn’t mean that it has to challenge your testimony. A lot has been discovered since some of these statements have been made. There is not as much to question about evolution anymore.

Questions on science and religion don’t need to challenge your faith. As social stigmatization arises, you can show your discipleship by your actions. If you believe that creation occurred following the laws of nature, that shouldn’t change your behavior or your belief and respect and love for humankind. That shouldn’t change how you follow the commandments. Just talk about your own belief and relationship with God, and focus on that. People are wrong sometimes, even church leaders. That is human. President Uchtdorf talked about that in the last General Conference. Our own belief in God need not be challenged by new knowledge. We don’t have to fear new scientific knowledge.

**Michael Stark:**

Other comments on that subject? Are there other questions that you have before you that you need answered? Paul, you first, and then Trent has one briefly.

**Paul Evans:**

One question here relates to this discussion, and it’s this idea that in the scriptures we have statements that may be construed as being literal and those that are perhaps symbolic and instructional. To follow up on what Emily said, if you run across some data inconsistent with your hypothesis, it does not change the fundamental truth underlying it. It might just mean that your interpretation of how things work is wrong, and you need to rework that. The experiential evidence you have is individual, and the faith you have continually tested and seen over the period of your life is not negated by the fact that you interpreted incorrectly how things work.

You just have to change that interpretation, and as a scientist, I throw out my hypotheses of how things work on a regular basis. I often hold five competing hypotheses at one time of how things work and to try to figure out how it goes

together. When I run across data not supported by my own experience and by others' observations, I can simply conclude that my hypothesis is wrong.

The question was, "How do you view the temple creation story, purely symbolic or literal?" I would just point out that throughout history of man, stories have been put together to explain how the world was created, and that's one possibility, but in reality if the true mechanism of how the world was created were given even today, let alone 2,000 years ago, it's very likely to be totally unintelligible.

I'm really looking forward sometime to seeing the movie that explains everything and how it works. I'll probably be so amazed by how it's so unlike how we *think* it works, I'll be amazed that it could have worked at all — in terms of our theories of how things work. But when I rent that movie, I do want to sit between Darwin and Joseph F. Smith to see their reactions. Better bring extra popcorn, Bob. So how do I view those stories of the creation that we have? My personal answer is that I see them as eternal and moral instructions delivered to me and to others in the framework of our temporary and material world. Somewhere in between are some elements we can connect with that help us relate, but it's an eternal and a very moral instruction and meant to make me a better person. So that's my answer.

**Steven Peck:**

One of the things that amazes me about scripture is its timelessness. That the same set of instructions and words and insights can be given to very ancient — and from our modern perspective, primitive — people, that meant something deeply to them, can thousands and thousands of years later be read by somebody in our culture, and for me this is the real power of scripture. The power of scripture is that they are deep enough and timeless enough to transcend culture and time, that they're written literally for every time, and that we can find value and insight and inspiration across these vastly different cultures is to me amazing. And for me, that's part of the depth I find.



**Trent Stephens:**

This question was directed specifically to me, "Can you elaborate on your suggestion that Adam's status as the first man is perhaps more a title than a chronological indicator, and the Fall of man associated with that?"

First of all let me say that I believe in a literal Adam and Eve, a literal Garden of Eden, a literal Tree of Life and Tree of Knowledge of Good and Evil, and that

the Fall was a specific event that happened. I view the Garden of Eden as a point of isolation because in the scriptures it's talked about in reference to other places. I view Adam and Eve as being plucked out of the mainstream of humanity, if you will, and isolated in the Garden of Eden — in fact, throughout the thirty years I taught anatomy, I constantly challenged my students who came up to me with questions — evolution is what I teach in anatomy and I'm also religious — when the students discover this, one of the first questions was, "How do you reconcile the two?" my question back quite startled most of them. I said, "Were Adam and Eve inherently immortal in the Garden of Eden?"

Inevitably the students would say, "Yes."

I would say, "Okay, a thousand dollars to whomever can give me the scripture that supports that." There is no scripture that supports that. Unless you canonize John Milton's *Paradise Lost*, then you have an easy case there. Then I ask the next question: "If Adam and Eve were inherently immortal, why was there a Tree of Life in the Garden of Eden?"

What was the function of the Tree of Life? It made them immortal. Well, duh! If they were already immortal, why do you have to have a tree to make them immortal? Why was it such a big deal to place cherubim and a flaming sword? Only one thing — not even the Ark of the Covenant — has been guarded by cherubim and a flaming sword. In the entire history of the world, only the Tree of Life. That was a pretty big deal. We're told it was guarded so Adam would not go back and partake of the fruit and live forever in his sin. That one sentence tells us an enormous amount.

Let's then consider that Adam and Eve were mortal beings plucked out of the mainstream of humanity and that beautiful, beautiful cave art you saw earlier by this person, who probably lived 12,000 years before Adam, who had put his or her handprint outline in this cave. You can't tell me that's not a human.

So here are a couple of possibilities: one, John Lewis suggested that Adam was the first person with a spirit, and we talked about the idea that agency doesn't have to be with the physical person but is more of the spiritual person; that's a very interesting concept. But there's another concept: John's reference to that suggests the 128<sup>th</sup> Section of the Doctrine and Covenants, which I immediately turned to and read, and it's very interesting because you have a comparison. You also see this in Corinthians, the comparison between Jesus Christ as the first fruits and Adam, as the first man, as the cause of the Fall, and Christ then atoned for the Fall. We know that Christ's Atonement is both anticipatory and retroactive. There is no question about that.

But we as Latter-day Saints have a very unique perspective on the Fall. Much of the rest of the Christian world believes that the Fall was an accident. An accident? With an omniscient God? That's incompatible. We know that the Fall was just as much a part of the plan as the Atonement was and that we all agreed to it in the Preexistence.

Now, I don't claim to understand why all of the Fall part was necessary; I don't understand it — I believe it, I don't understand it. But what if — this is my speculation — what if Adam and Eve were put in the Garden of Eden for the purpose of partaking of the Tree of Knowledge of Good and Evil (we know that) and that the words, “first man” is not a chronological statement but a title of position? He was the representative for all of us in the Fall, and that representation was not just anticipatory for everyone born after Adam, but it was also retroactive for everyone born before Adam, who would have also agreed to that same plan. It makes perfect sense from a scriptural perspective. I'm still tinkering with it.

**Michael Stark:**

All right, thank you, Trent for expounding on that subject. I hope you can see from the biologists — not just on this panel but from the community of LDS biologists whom we represent — that they are at their core thoughtful, humble individuals trying to understand our place on this earth, how we relate ourselves to our Father in Heaven, and so forth.

And we'll end with this question — and I think we've answered it implicitly throughout the day — “Do you know or do you believe that God is real?” I hope all of us and all of you have taken the opportunity to build a relationship with your Heavenly Father and through personal revelation and experiences that you know certain things. And we are, as Trent is, still tinkering with some ideas, still wondering about many things, and hoping to come to a better knowledge to look forward to in the future. Thank you very much.





# LDS STATEMENTS ON EVOLUTION AND THE ORIGIN OF MAN

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**BYU Packet on Evolution and the Origin of Man, 1992<sup>1</sup>**

October, 1992

**Evolution and the Origin of Man**

This packet contains, as far as could be found, all statements issued by the First Presidency of The Church of Jesus Christ of Latter-day Saints on the subject of evolution and the origin of man, and a statement on the Church's attitude toward science. The earliest First Presidency Statement, "The Origin of Man," was issued during the administration of President Joseph F. Smith in 1909. This was followed by a First Presidency Message in 1910 that included brief comments related to the study of these topics. The second statement, "Mormon View of Evolution," was issued during the administration of President Heber J. Grant in 1925. Although there has never been a formal declaration from the First Presidency addressing the general matter of organic evolution as a process for development of biological species, these documents make clear the official position of the Church regarding the origin of man.

This packet also contains the article on evolution from the *Encyclopedia of Mormonism*, published in 1992. The current First Presidency authorized inclusion of the excerpt from the First Presidency minutes of 1931 in the 1992 Encyclopedia article.

Various views have been expressed by other Church leaders on this subject over many decades; however, formal statements by the First Presidency are the definitive source of official Church positions. It is hoped that these materials will provide a firm foundation for individual study in a context of faith in the restored gospel.

Approved by the BYU Board of Trustees

June, 1992

*Improvement Era* 13:1, pp. 75-81. Nov. 1909.

### **Editor's Table: The Origin of Man**

By The First Presidency of the Church.

“God created man in his own image.”

Inquiries arise from time to time respecting the attitude of The Church of Jesus Christ of Latter-day Saints upon questions which, though not vital from a doctrinal standpoint, are closely connected with the fundamental principles of salvation. The latest inquiry of this kind that has reached us is in relation to the origin of man. It is believed that a statement of the position held by the Church upon this important subject will be timely and productive of good.

In presenting the statement that follows we are not conscious of putting forth anything essentially new; neither is it our desire so to do. Truth is what we wish to present, and truth — eternal truth — is fundamentally old. A restatement of the original attitude of the Church relative to this matter is all that will be attempted here. To tell the truth as God has revealed it, and commend it to the acceptance of those who need to conform their opinions thereto, is the sole purpose of this presentation.

“God created man in his own image, in the image of God created he him; male and female created he them.” In these plain and pointed words the inspired author of the book of Genesis made known to the world the truth concerning the origin of the human family. Moses, the prophet-historian, “learned,” as we are told, “in all the wisdom of the Egyptians,” when making this important announcement, was not voicing a mere opinion, a theory derived from his researches into the occult lore of that ancient people. He was speaking as the mouthpiece of God, and his solemn declaration was for all time and for all people. No subsequent revelator of the truth has contradicted the great leader and lawgiver of Israel. All who have since spoken by divine authority upon this theme have confirmed his simple and sublime proclamation. Nor could it be otherwise. Truth has but one source, and all revelations from heaven are harmonious with each other. The omnipotent Creator, the maker of heaven and earth — had shown unto Moses everything pertaining to this planet, including the facts relating to man’s origin, and the authoritative pronouncement of that mighty prophet and seer to the house of Israel, and through Israel to the whole world, is couched in the simple clause: “God created man in his own image” (Genesis 1:27; Moses 1:27-41).

The creation was twofold — firstly spiritual, secondly temporal. This truth, also, Moses plainly taught — much more plainly than it has come down to us in the imperfect translations of the Bible that are now in use. Therein the fact of a spiritual creation, antedating the temporal creation, is strongly implied, but the proof of it is

not so clear and conclusive as in other records held by the Latter-day Saints to be of equal authority with the Jewish scriptures. The partial obscurity of the latter upon the point in question is owing, no doubt, to the loss of those “plain and precious” parts of sacred writ, which, as the Book of Mormon informs us, have been taken away from the Bible during its passage down the centuries (1 Nephi 13:24-29). Some of these missing parts the Prophet Joseph Smith undertook to restore when he revised those scriptures by the spirit of revelation, the result being that more complete account of the creation which is found in the book of Moses, previously cited. Note the following passages:

And now, behold, I say unto you, that these are the generations of the heaven and of the earth, when they were created, in the day that I, the Lord God, made the heaven and the earth;

And every plant of the field before it was in the earth, and every herb of the field before it grew.

For I, the Lord God, created all things of which I have spoken, spiritually, before they were naturally upon the face of the earth. For I, the Lord God, had not caused it to rain upon the face of the earth.

And I, the Lord God, had created all the children of men, and not yet a man to till the ground; for in heaven created I them, and there was not yet flesh upon the earth, neither in the water, neither in the air.

But, I, the Lord God, spake, and there went up a mist from the earth, and watered the whole face of the ground.

And I, the Lord God, formed man from the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul, the first flesh upon the earth, the first man also.

Nevertheless, all things were before created, but spiritually were they created and made, according to my word (Moses 3:4-7. See also chapters 1 and 2, and compare with Genesis 1 and 2).

These two points being established, namely, the creation of man in the image of God, and the two-fold character of the creation, let us now inquire: What was the form of man, in the spirit and in the body, as originally created? In a general way the answer is given in the words chosen as the text of this treatise. “God created man in his own image.” It is more explicitly rendered in the Book of Mormon thus: “All men were created in the beginning after mine own image” (Ether 3:15). It is the Father who is speaking. If, therefore, we can ascertain the form of the “Father of spirits,” “The God of the spirits of all flesh,” we shall be able to discover the form of the original man.

Jesus Christ, the Son of God, is “the express image” of His Father’s person (Hebrews 1:3). He walked the earth as a human being, as a perfect man, and said, in answer to a question put to Him: “He that hath seen me hath seen the Father” (John 14:9). This

alone ought to solve the problem to the satisfaction of every thoughtful, reverent mind. The conclusion is irresistible, that if the Son of God be the express image (that is, likeness) of His Father's person, then His Father is in the form of man; for that was the form of the Son of God, not only during His mortal life, but before His mortal birth, and after His resurrection. It was in this form that the Father and the Son, as two personages, appeared to Joseph Smith, when, as a boy of fourteen years, he received his first vision. Then if God made man — the first man — in His own image and likeness, he must have made him like unto Christ, and consequently like unto men of Christ's time and of the present day. That man was made in the image of Christ is positively stated in the book of Moses: "And I, God, said unto mine Only Begotten, which was with me from the beginning, Let us make man in our image, after our likeness; and it was so. \* \* \* \* And I, God, created man in mine own image, in the image of mine Only Begotten created I him, male and female created I them" (Moses 2:26, 27).

The Father of Jesus is our Father also. Jesus Himself taught this truth, when He instructed His disciples how to pray: "Our Father which art in heaven," etc. Jesus, however, is the firstborn among all the sons of God — the first begotten in the spirit, and the only begotten in the flesh. He is our elder brother, and we, like Him, are in the image of God. All men and women are in the similitude of the universal Father and Mother, and are literally the sons and daughters of Deity.

"God created man in His own image." This is just as true of the spirit as it is of the body, which is only the clothing of the spirit, its complement; the two together constituting the soul. The spirit of man is in the form of man, and the spirits of all creatures are in the likeness of their bodies. This was plainly taught by the Prophet Joseph Smith (Doctrine and Covenants 77:2).

Here is further evidence of the fact. More than seven hundred years before Moses was shown the things pertaining to this earth, another great prophet, known to us as the brother of Jared, was similarly favored by the Lord. He was even permitted to behold the spirit-body of the foreordained Savior, prior to His incarnation; and so like the body of a man was gazing upon a being of flesh and blood. He first saw the finger and then the entire body of the Lord — all in the spirit. The Book of Mormon says of this wonderful manifestation:

And it came to pass that when the brother of Jared had said these words, behold the Lord stretched forth His hand and touched the stones one by one with His finger; and the veil was taken from off the eyes of the brother of Jared, and he saw the finger of the Lord; and it was as the finger of a man, like unto flesh and blood; and the brother of Jared fell down before the Lord, for he was struck with fear.

And the Lord saw that the brother of Jared had fallen to the earth; and the Lord said unto him, Arise, why hast thou fallen?

And he saith unto the Lord, I saw the finger of the Lord, and I feared lest he should smite me; for I knew not that the Lord had flesh and blood.

And the Lord said unto him, Because of thy faith thou hast seen that I shall take upon me flesh and blood; and never has man come before me with such exceeding faith as thou hast; for were it not so, ye could not have seen my finger. Sawest thou more than this?

And he answered, Nay, Lord, show thyself unto me.

And the Lord said unto him, Believest thou the words which I shall speak?

And he answered, Yea, Lord, I know that thou speakest the truth, for thou art a God of truth and canst not lie.

And when he had said these words, behold, the Lord showed himself unto him, and said, Because thou knowest these things ye are redeemed from the fall; therefore ye are brought back into my presence; therefore I show myself unto you.

Behold, I am He who was prepared from the foundation of the world to redeem my people. Behold, I am Jesus Christ, I am the Father and the Son. In me shall all mankind have light, and that eternally, even they who shall believe on my name; and they shall become my sons and my daughters.

And never have I shewed myself unto man whom I have created, for never hath man believed in me as thou hast. Seest thou that ye are created after mine own image? Yea, even all men were created in the beginning after mine own image.

Behold, this body, which ye now behold, is the body of my spirit, and man have I created after the body of my spirit; and even as I appear unto thee to be in the spirit, will I appear unto my people in the flesh. (Ether 3:6-16.)

What more is needed to convince us that man, both in spirit and in body, is the image and likeness of God, and that God Himself is in the form of man?

When the divine Being whose spirit-body the brother of Jared beheld, took upon Him flesh and blood, He appeared as a man, having “body, parts and passions,” like other men, though vastly superior to all others, because He was God, even the Son of God, the Word made flesh: in Him “dwelt the fulness of the Godhead bodily.” And why should He not appear as a man? That was the form of His spirit, and it must needs have an appropriate covering, a suitable tabernacle. He came unto the world as He had promised to come (3 Nephi 1:13), taking an infant tabernacle, and developing it gradually to the fulness of His spirit stature. He came as man had been coming for ages, and as man has continued to come ever since. Jesus, however, as shown, was the only begotten of God in the flesh.

Adam, our great progenitor, “the first man,” was, like Christ, a preexistent spirit, and like Christ he took upon him an appropriate body, the body of a man, and so became a “living soul.” The doctrine of the preexistence, — revealed so plainly, particularly in latter days, pours a wonderful flood of light upon the otherwise mysterious problem of man’s origin. It shows that man, as a spirit, was begotten and born of heavenly parents, and reared to maturity in the eternal mansions of the Father, prior to coming upon the earth in a temporal body to undergo an experience

in mortality. It teaches that all men existed in the spirit before any man existed in the flesh, and that all who have inhabited the earth since Adam have taken bodies and become souls in like manner.

It is held by some that Adam was not the first man upon this earth, and that the original human being was a development from lower orders of the animal creation. These, however, are the theories of men. The word of the Lord declares that Adam was “the first man of all men” (Moses 1:34), and we are therefore in duty bound to regard him as the primal parent of our race. It was shown to the brother of Jared that all men were created in the beginning after the image of God; and whether we take this to mean the spirit or the body, or both, it commits us to the same conclusion: Man began life as a human being, in the likeness of our heavenly Father.

True it is that the body of man enters upon its career as a tiny germ or embryo, which becomes an infant, quickened at a certain stage by the spirit whose tabernacle it is, and the child, after being born, develops into a man. There is nothing in this, however, to indicate that the original man, the first of our race, began life as anything less than a man, or less than the human germ or embryo that becomes a man.

Man, by searching, cannot find out God. Never, unaided, will he discover the truth about the beginning of human life. The Lord must reveal Himself, or remain unrevealed; and the same is true of the facts relating to the origin of Adam’s race — God alone can reveal them. Some of these facts, however, are already known, and what has been made known it is our duty to receive and retain.

The Church of Jesus Christ of Latter-day Saints, basing its belief on divine revelation, ancient and modern, proclaims man to be the direct and lineal offspring of Deity. God Himself is an exalted man, perfected, enthroned, and supreme. By His almighty power He organized the earth, and all that it contains, from spirit and element, which exist co-eternally with Himself. He formed every plant that grows, and every animal that breathes, each after its own kind, spiritually and temporally — “that which is spiritual being in the likeness of that which is temporal, and that which is temporal in the likeness of that which is spiritual.” He made the tadpole and the ape, the lion and the elephant but He did not make them in His own image, nor endow them with Godlike reason and intelligence. Nevertheless, the whole animal creation will be perfected and perpetuated in the Hereafter, each class in its “distinct order or sphere,” and will enjoy “eternal felicity.” That fact has been made plain in this dispensation (Doctrine and Covenants 77:3).

Man is the child of God, formed in the divine image and endowed with divine attributes, and even as the infant son of an earthly father and mother is capable in due time of becoming a man, so the undeveloped offspring of celestial parentage is capable, by experience through ages and aeons, of evolving into a God.

Joseph F. Smith,  
John R. Winder,  
Anthon H. Lund,

First Presidency of The Church of Jesus Christ of Latter-day Saints.

**Words in Season from the First Presidency**

*Deseret Evening News*, Dec. 17, 1910, part 1, p. 3.

In this Christmas message, the First Presidency devoted several sentences to the Church's position with regard to questions raised by science:

Diversity of opinion does not necessitate intolerance of spirit, nor should it embitter or set rational beings against each other. The Christ taught kindness, patience, and charity.

Our religion is not hostile to real science. That which is demonstrated, we accept with joy; but vain philosophy, human theory and mere speculations of men, we do not accept nor do we adopt anything contrary to divine revelation or to good common sense. But everything that tends to right conduct, that harmonizes with sound morality and increases faith in Deity, finds favor with us no matter where it may be found.



**Editors' Table: "Mormon" View of Evolution**

*Improvement Era*, Vol. XXVIII September, 1925 No. 11

"God created man in his own image, in the image of God created he him: male and female created he them."

In these plain and pointed words the inspired author of the book of Genesis made known to the world the truth concerning the origin of the human family. Moses, the prophet-historian, who was "learned" we are told, "in all the wisdom of the Egyptians," when making this important announcement, was not voicing a mere opinion. He was speaking as the mouthpiece of God, and his solemn declaration was for all time and for all people. No subsequent revelator of the truth has contradicted the great leader and law-giver of Israel. All who have since spoken by divine authority upon this theme have confirmed his simple and sublime proclamation. Nor could it be otherwise. Truth has but one source, and all revelations from heaven are harmonious one with the other.

Jesus Christ, the Son of God, is "the express image" of his Father's person (Hebrews 1:3). He walked the earth as a human being, as a perfect man, and said, in answer to a question put to him: "He that hath seen me hath seen the Father" (John 14:9). This alone ought to solve the problem to the satisfaction of every thoughtful, reverent mind. It was in this form that the Father and the Son, as two distinct personages, appeared to Joseph Smith, when, as a boy of fourteen years, he received his first vision.

The Father of Jesus Christ is our Father also. Jesus himself taught this truth, when he instructed his disciples how to pray: "Our Father which art in heaven," etc. Jesus, however, is the first born among all the sons of God — the first begotten in the spirit, and the only begotten in the flesh. He is our elder brother, and we, like him, are in the image of God. All men and women are in the similitude of the universal Father and Mother, and are literally sons and daughters of Deity.

Adam, our great progenitor, "the first man," was, like Christ, a preexistent spirit, and, like Christ, he took upon him an appropriate body, the body of a man, and so became a "living soul." The doctrine of preexistence pours a wonderful flood of light upon the otherwise mysterious problem of man's origin. It shows that man, as a spirit, was begotten and born of heavenly parents, and reared to maturity in the eternal mansions of the Father, prior to coming upon the earth in a temporal body to undergo an experience in mortality.

The Church of Jesus Christ of Latter-day Saints, basing its belief on divine revelation, ancient and modern, proclaims man to be the direct and lineal offspring of Deity. By his Almighty power God organized the earth, and all that it contains, from spirit and element, which exist co-eternally with himself.

Man is the child of God, formed in the divine image and endowed with divine attributes, and even as the infant son of an earthly father and mother is capable in due time of becoming a man, so the undeveloped offspring of celestial parentage is capable, by experience through ages and aeons, of evolving into a God.

Heber J. Grant,  
Anthony W. Ivins,  
Charles W. Nibley.

First Presidency.

**Evolution**

*Encyclopedia of Mormonism*, Vol. 2

William E. Evenson

The position of the Church on the origin of man was published by the First Presidency in 1909 and stated again by a different First Presidency in 1925:

The Church of Jesus Christ of Latter-day Saints, basing its belief on divine revelation, ancient and modern, declares man to be the direct and lineal offspring of Deity. ... Man is the child of God, formed in the divine image and endowed with divine attributes [see statement of the First Presidency above].

The scriptures tell why man was created, but they do not tell how, though the Lord has promised that he will tell that when he comes again (D&C 101:32-33). In 1931, when there was intense discussion on the issue of organic evolution, the First Presidency of the Church, then consisting of Presidents Heber J. Grant, Anthony W. Ivins, and Charles W. Nibley, addressed all of the General Authorities of the Church on the matter, and concluded,

Upon the fundamental doctrines of the Church we are all agreed. Our mission is to bear the message of the restored gospel to the world. Leave geology, biology, archaeology, and anthropology, no one of which has to do with the salvation of the souls of mankind, to scientific research, while we magnify our calling in the realm of the Church.

Upon one thing we should all be able to agree, namely, that Presidents Joseph F. Smith, John R. Winder, and Anthon H. Lund were right when they said: "Adam is the primal parent of our race" [First Presidency Minutes, Apr. 7, 1931]

### Background of the BYU Packet

In response to student questions about the view of the Church on organic evolution and the origin of man, a packet was approved by Brigham Young University's Board of Trustees — consisting of the First Presidency, some members of the Quorum of the Twelve, and other General Authorities and officers. Following approval, the packet was made available to students and faculty of BYU, and in 1999 it was distributed to all teachers in the Church Education System. The following article, from page 3 of the November 12, 1992 issue of BYU's student newspaper *The Daily Universe*, explains the origins of the packet. The author of the article is William E. Evenson, who at that time was Dean of the College of Physical and Mathematical Sciences and Professor of Physics at BYU. Following this article, background material relating to the statements in the packet is provided.

#### William E. Evenson: BYU Packet Defined, 1992

In the interest of clarifying the background and purpose of the library packet on evolution and the origin of man, which was announced in the *Daily Universe* on Thursday, Oct. 29, I provide the following information about the development of this packet and the motivation for it.

As appropriate at any university, the subject of organic evolution and the origin of man comes up in BYU courses in several departments. In these courses, students naturally wish to know the official position of the LDS Church on this subject. Some faculty members in the sciences and in Religious Education have gathered material on these topics to distribute to their students. Students might receive one set of statements by Church leaders from one professor and a different set from another professor.

Several faculty members and administrators felt the diversity of materials on these subjects, which were often selected to emphasize the views of the professor, tended to create confusion in the minds of the students and accentuate the potential for controversy about the Church's position. In 1991, in response to questions from students about the Church position on evolution, [BYU] President Rex E. Lee authorized that one of these packets be placed in the [Harold B. Lee Library] Reserve Library as a source for information about the Church's position on evolution and the origin of man.

**Purpose of Packet.** Because of my experience in preparing the evolution article for the *Encyclopedia of Mormonism*, I was asked by Provost Bruce Hafen to consider a packet that could be made available to students as the official and fundamental Church position on this subject. It was immediately clear that the selection of material for such a packet could not depend on the content of the statements. The goal is not to achieve some kind of "balance" among the views that have been expressed, but to give students the full range of official views so that they can judge the different

positions they encounter. The full range of official views should provide the basis for the evaluation of other views that have been expressed but that do not have the status of official positions.

In line with this philosophical stance, I prepared an initial draft of the packet, which contained the First Presidency statements and all published statements made by presidents of the Church during the time they held that office. It also included the speech given in 1931 by James Talmage of the Quorum of the Twelve, which was reviewed and approved by the First Presidency and officially published by the Church. Finally, this draft packet included the *Encyclopedia of Mormonism* article because of the excerpt from the First Presidency Minutes in 1931 about the Church's stance toward scientific studies of evolution and the origin of man. This packet was made entirely of materials with official status and included all of the statements published by or with the authorization of the First Presidency.

The draft packet's contents were discussed amicably with Dean Robert Millet of Religious Education and Provost Hafen. After considerable discussion, we agreed that the official university packet should contain only those items that represent the official position of the Church, i.e., statements from the First Presidency. The encyclopedia article was kept because of the First Presidency Minutes item included in it, which is not otherwise available to the public. The final packet was then reviewed by BYU's Board of Trustees — consisting of the First Presidency, many members of the Quorum of the Twelve and other general authorities and officers. They approved the packet.

**Balance not the issue.** Again, I emphasize that balance was not the issue. The issue was providing only those materials that could clearly be said to be the official, declared position of the Church.

None of us involved in preparing this packet for Board review anticipate that professors will be limited from distributing other materials to their students. It is only requested that BYU faculty members refer students to the materials in this specific packet along with the other items they may choose to distribute. When other items are distributed, they should be clearly separated and given as a supplement to this material and include a fair sampling of the diverse viewpoints among LDS leaders. For example, if one included statements by LDS apostles in a handout on evolution, the range of views would include some statements against evolution, some sympathetic to evolution and several shades of opinion in between. We want to avoid the implication that a greater sense of unanimity or resolution of this topic exists than is actually the case, and we are eager to avoid contention. The university has also suggested that faculty members limit supplemental LDS material on the subject of evolution and the origin of man to published documents, avoiding private letters or other private material.

The process was one of constructive and harmonious effort to provide materials from which students could see clearly the foundation of LDS doctrine on this subject and distinguish it from the wide variety of opinions encountered in LDS literature.

### Context for Statements in the BYU Packet

**First Presidency Statement: The Origin of Man, 1909.** The year 1909 was both the centennial of Charles Darwin's birth and the 50-year anniversary of the publication of his *The Origin of Species*. Regarding the circumstances of the issuance of this statement, James R. Clark writes:

What prompted the First Presidency to issue this definite statement on the Origin of Man at this particular time could not be determined by the writer of these notes.

However, there had appeared in the April, 1908, issue of the *Improvement Era* an article announcing the death of [British mathematical physicist] William Thompson or Lord Kelvin on December 17, 1907. The article was written by a prominent LDS scientist, Dr. John A. Widtsoe, President of the Agricultural College of Utah at Logan, now Utah State University.

Since *The Improvement Era* was an official organ of the LDS Church and widely read throughout the Church, some of the statements in the Widtsoe article may have been responsible for some of the 'Inquiries... respecting the attitude of the Church...' on the subject.

Pertinent to the subject of the Origin of Man are the following quotations from Widtsoe's review of the views of Lord Kelvin on this subject:

Not only did Lord Kelvin believe that God lives and rules, but he had no sympathy with the idle notion of the day that life began upon this earth and will disappear with death. He believed in the eternity of life, and that life had come to this earth from other heavenly bodies. True, he did not understand the full philosophy of life's beginnings on the earth, but certainly with all the power at his command as the great scientist of his day, he refuted many of the modern theories which teach the origin of life on this earth without the intervention of an overruling Providence (IE 11:402).

After quoting again from the writings of Lord Kelvin, Widtsoe comments:

Carefully read, this paragraph [from Kelvin] will be found to teach that life is eternal; that life on this earth came from other spheres, that the law of natural selection is imperfect, and does not account for the variety of living things; that the law of evolution is true only as it conforms to the law of progression; that the whole of nature teaches the existence of a great designer or great governing power; and that finally; the power of free agency encircles our lives (IE 11:403).

Widtsoe then quotes at length from the Presidential Address of Lord Kelvin to the British Association, Edinburgh, 1871, including Kelvin's statement that he could not accept the hypothesis of the origin of species by natural selection, 'because

I have always felt that this hypothesis does not contain the true theory of evolution, if evolution there has been, in biology.’

Widtsoe’s final paragraph had said:

Does Mormonism agree with the same talks of Lord Kelvin? All who understand it will say, yes. The science of the world is, and can be no more than one phase of the everlasting gospel of Jesus Christ which embraces all truth....

This statement of the First Presidency in 1909 still remains perhaps the most thorough and complete statement on the subject issued by the First Presidency to date (1969). [The] statement by President Heber J. Grant and his counselors in the First Presidency in 1925 and entitled ‘The Mormon View of Evolution’ [included in this appendix] will be seen by comparison between the two to be a briefer version of the same statement in the identical language.<sup>2</sup>

Terryl L. Givens, *Wrestling*, pp. 217-218, has made pertinent observations with respect to the following statement:

It is held by some that Adam was not the first man upon this earth and that the original human being was a development from lower orders of the animal creation. These, however, are the theories of men. The word of the Lord declared that Adam was “the first man of all men” (Moses 1:34), and we are therefore in duty bound to regard him as the primal parent of our race.

Givens notes that the statement “cautioned against but did not repudiate the theory” of evolution:

The real purport of the statement was to sideline the question of human origins as unimportant and impossible of definitive resolution: only “some of these facts” touching on human creation are known, it urged. What is certain is that “man is the child of God, formed in the divine image and endowed with divine attributes.” Following the Scopes trial, the Church ... [reissued] their statement but with the cautionary language about the “theories of men” conspicuously absent.

**First Presidency Statement: Words in Season, 1910.** Nothing is known about the specific background of the 1910 statement, however its timing in light of other writings by President Smith and his associates in Church publications and of the controversies on curriculum content at Church schools seems to suggest a perceived need to reaffirm that “Our religion is not hostile to real science.”

**First Presidency Statement: “Mormon” View of Evolution, 1925.** James R. Clark writes:

The predecessor of this statement on the “Mormon View of Evolution” is the statement of the First Presidency on “The Origin of Man” published November, 1909.<sup>3</sup> In fact, the present statement in paragraphs 1 through 5 constitutes extracts from paragraphs 3, 13, 14, 30, 34, and 35, respectively, of the 1909 statement, It

therefore constitutes a shortened or condensed form of the statement issued by the former First Presidency — Joseph F. Smith, John R. Winder and Anthon H. Lund.

The occasion prompting the issuance of this later condensed version by President Heber J. Grant and his counselors is not given in the *Improvement Era* where it was published.

However, in July, 1925, Darwinism had attracted international attention when John T. Scopes, a young high school teacher, had disobeyed the law of the State of Tennessee by teaching Darwinism or evolution. He was convicted and the results of the trial had national and international repercussions. Discussion was widespread in LDS circles. Under these circumstances, the title of the message itself is not without significance.<sup>4</sup>

**Encyclopedia of Mormonism: Evolution, 1991.** Regarding the background of this article, the author William E. Evenson has written:

Because of a fairly broad science background as a physics professor with research interests in evolutionary biology, I was asked to write the article on evolution for the *Encyclopedia of Mormonism*. This article went through a long process of refinement and review. It was originally to be 1,000 words long, then was revised to 2,500 words, to 3,500 words, and to 4,500 words. Finally, in the spring of 1991, the First Presidency and Quorum of the Twelve reviewed my last two versions, and a more anti-evolutionary revision of my article by someone else connected with the *Encyclopedia*. The Brethren decided that they wanted only a short article referring to the First Presidency statements on this subject, which are the only definitive sources of Church doctrine. The resulting entry in the *Encyclopedia* is only 258 words long.<sup>5</sup>

In this article is a quote from the 1931 minutes of the First Presidency, recorded at a time “when there was intense discussion on the issue of organic evolution.” Specifically, doctrinal issues relating to a decision about the publication of Elder B. H. Roberts’ manuscript *The Truth, the Way, the Life*<sup>6</sup> were then under consideration. As Evenson points out, however, these discussions “were not centered on the scientific theories of origins of life forms. Rather, the central point of concern was whether death occurred on Earth before the Fall of Adam.”<sup>7</sup> Roberts found evolutionary theory to be inadequate, and thus formulated his own theory as an attempt to reconcile the scriptures with science.

Though the 1931 First Presidency statement was specifically made in response to the question of death before the Fall that was raised by Roberts’ manuscript, its application to the broader context of evolution was deemed appropriate by later Church leaders. Writes Evenson:

It was at [the] initiative [of the First Presidency and members of the Twelve], and specifically by the action of then-First Counselor Gordon B. Hinckley, that the 1931 counsel was supplied to be used in the *Encyclopedia* to indicate the church’s position in 1992. This updates the 1931 counsel and gives it focus directly to



modern conditions. The *Encyclopedia* and other writers are quite correct in citing it as a currently valid statement.<sup>8</sup>

The quotation of the 1909 statement of the First Presidency in the article erroneously substitutes the word “declares” for “proclaims.” The statement should read as follows (emphasis added):

The Church of Jesus Christ of Latter-day Saints, basing its belief on divine revelation, ancient and modern, proclaims man to be the direct and lineal offspring of Deity.

### **Additional Statements Relating to Evolution and the Origin of Man**

This section contains all known statements relating to evolution and the origin of man from Presidents of the Church that were made while they served as president, and that were not already part of the BYU Packet. Private letters to individuals have not been included.

In addition, an article from the *Encyclopedia of Mormonism* by John L. Sorenson on the origin of man is reprinted here. Although the *Encyclopedia of Mormonism* is not an official publication of the Church, the front matter of the *Encyclopedia* explains the role of General Authorities in the publication project:

Two members of the [BYU] Board of Trustees of the university, who are also members of the Quorum of the Twelve Apostles, were appointed by the First Presidency to serve as advisers to the project: Elder Neal A. Maxwell and Elder Dallin H. Oaks. Other General Authorities who accepted special assignments related to the project include four members of the Quorum of Seventy: Elders Dean L. Larsen, Carlos E. Asay, Marlin K. Jensen, and Jeffrey R. Holland.

**President Brigham Young: The Human Species Are Linked to the Animal<sup>9</sup>**

[The President] observed that naturalists have divided the kingdom into parts. This is not so, as the human species are linked to the animal and the creation to all one according to its several gradations. It is the design of the Father to continually protect us through numerous gradations to increase the intelligence of the human family for their enjoyment, even all those who yield to the teachings of the spirit and obey the law of their probation. Those who deny the Holy Ghost will return to native element and lose their identity.

**President John Taylor: Immutability of Living Forms, 1882<sup>10</sup>**

The animal and vegetable creations are governed by certain laws, and are composed of certain elements peculiar to themselves. This applies to man, to the beasts, fowls, fish and creeping things, to the insects and to all animated nature; each one possessing its own distinctive features, each requiring a specific sustenance, each having an organism and faculties governed by prescribed laws to perpetuate its own kind. So accurate is the formation of the various living creatures that an intelligent student of nature can tell by any particular bone of the skeleton of an animal to what class or order it belongs.

These principles do not change, as represented by evolutionists of the Darwinian school, but the primitive organisms of all living beings exist in the same form as when they first received their impress from the Maker. There are, indeed, some very slight exceptions, as for instance, the ass may mix with the mare and produce the mule; but there it ends, the violation of the laws of procreation receives a check, and its operations can go no further. Yet this is not the normal, but an abnormal condition with them, as with animals, birds, etc.; and if we take man, he is said to have been made in the image of God, for the simple reason that he is a son of God; and being His son, he is, of course, His offspring, an emanation from God, in whose likeness, we are told, he is made. He did not originate from a chaotic mass of matter, moving or inert, but came forth possessing, in an embryonic state, all the faculties and powers of a God. And when he shall be perfected, and have progressed to maturity, he will be like his Father — a God, being indeed His offspring. As the horse, the ox, the sheep, and every living creature, including man, propagates its own species and perpetuates its own kind, so does God perpetuate His.

**President Joseph F. Smith et al.: Creation of Adam and Eve, 1910<sup>11</sup>**

“In just what manner did the mortal bodies of Adam and Eve come into existence on this earth?” This question comes from several High Priests’ quorums.

Of course, all are familiar with the statements in Genesis 1:26-27; 2:7; also in the Book of Moses, Pearl of Great Price, 2:27; and in the book of Abraham 5:7. The latter statement reads: “And the Gods formed man from the dust of the ground, and took his spirit (that is, the man’s spirit) and put it into him; and breathed into his nostrils the breath of life, and man became a living soul.”

These are the authentic statements of the scriptures, ancient and modern, and it is best to rest with these, until the Lord shall see fit to give more light on the subject. Whether the mortal bodies of man evolved in natural processes to present perfection, through the direction and power of God; whether the first parents of our generations, Adam and Eve, were transplanted from another sphere, with immortal tabernacles, which became corrupted through sin and the partaking of natural foods, in the process of time; whether they were born here in mortality, as other mortals have been, are questions not fully answered in the revealed word of God. For helpful discussion of the subject, see *Improvement Era*, Vol. XI, August 1908, No. 10, page 778, article, Creation and Growth of Adam; also article by the First Presidency, Origin of Man, Vol. XIII, No. 1, page 75, 1909.

**President Joseph F. Smith: Philosophy and the Church Schools, 1915<sup>12</sup>**

Some questions have arisen about the attitude of the Church on certain discussions of philosophy in the Church schools. Philosophical discussions as we understand them, are open questions about which men of science are very greatly at variance. As a rule we do not think it advisable to dwell on questions that are in controversy, and especially questions of a certain character, in the courses of instruction given by our institutions. In the first place it is the mission of our institutions of learning to qualify our young people for the practical duties of life. It is much to be preferred that they emphasize the industrial and practical side of education. Students are very apt to draw the conclusion that whichever side of a controversial question they adopt is the truth, the whole truth, and nothing but the truth; and it is very doubtful therefore, whether the great mass of our students have sufficient discriminating judgment to understand very much about some of the advanced theories of philosophy or science.

Some subjects are in themselves, perhaps, perfectly harmless, and any amount of discussion over them would not be injurious to the faith of our young people. We are told, for example, that the theory of gravitation is at best a hypothesis and that such is the atomic theory. These theories help to explain certain things about nature. Whether they are ultimately true can not make much difference to the religious convictions of our young people. On the other hand there are speculations which touch the origin of life and the relationship of God to his children. In a very limited degree that relationship has been defined by revelation, and until we receive more light upon the subject we deem it best to refrain from the discussion of certain philosophical theories which rather destroy than build up the faith of our young people. One thing about this so-called philosophy of religion that is very undesirable, lies in the fact that as soon as we convert our religion into a system of philosophy none but philosophers can understand, appreciate, or enjoy it. God, in his revelation to man has made His word so simple that the humblest of men without especial training, may enjoy great faith, comprehend the teachings of the Gospel, and enjoy undisturbed their religious convictions. For that reason we are averse to the discussion of certain philosophical theories in our religious instructions. If our Church schools would confine their so-called course of study in biology to that knowledge of the insect world which would help us to eradicate the pests that threaten the destruction of our crops and our fruit, such instruction would answer much better the aims of the Church school, than theories which deal with the origin of life.

These theories may have a fascination for our teachers and they may find interest in the study of them, but they are not properly within the scope of the purpose for which these schools were organized.

Some of our teachers are anxious to explain how much of the theory of evolution, in their judgment, is true, and what is false, but that only leaves their students in an unsettled frame of mind. They are not old enough and learned enough to

discriminate, or put proper limitations upon a theory which we believe is more or less a fallacy. In reaching the conclusion that evolution would be best left out of discussions in our Church schools we are deciding a question of propriety and are not undertaking to say how much of evolution is true, or how much is false. We think that while it is a hypothesis, on both sides of which the most eminent scientific men of the world are arrayed, that it is folly to take up its discussion in our institutions of learning; and we can not see wherein such discussions are likely to promote the faith of our young people. On the other hand we have abundant evidence that many of those who have adopted in its fulness the theory of evolution have discarded the Bible, or at least refused to accept it as the inspired word of God. It is not, then, the question of the liberty of any teacher to entertain whatever views he may have upon this hypothesis of evolution, but rather the right of the Church to say that it does not think it profitable or wise to introduce controversies relative to evolution in its schools. Even if it were harmless from the standpoint of our faith, we think there are things more important to the daily affairs of life and the practical welfare of our young people. The Church itself has no philosophy about the *modus operandi* employed by the Lord in His creation of the world, and much of the talk therefore, about the philosophy of Mormonism is altogether misleading. God has revealed to us a simple and effectual way of serving Him, and we should regret very much to see the simplicity of those revelations involved in all sorts of philosophical speculations. If we encouraged them it would not be long before we should have a theological scholastic aristocracy in the Church, and we should therefore not enjoy the brotherhood that now is, or should be common to rich and poor, learned and unlearned among the Saints.

**President David O. McKay: Design Permeating All Creation, 1952<sup>13</sup>**

“The most choice opportunity of the religious teacher should be to lead the child to see through the trouble and turmoil of a troubled world that,” note students, “in all His dispensation God is at work for our good. In prosperity he tries our gratitude, in mediocrity, our contentment, in misfortune, our submission, in darkness, our faith, under temptation our steadfastness, and at all times our obedience and trust in Him.” There is a perpetual design permeating all purposes of Creation. On these thoughts, science again leads the student up to a certain point and sometimes leads him with his soul unanchored. Millikan is right when he says, “Science without religion obviously may become a curse rather than a blessing to mankind.” But, science dominated by the spirit of religion is the key progress and the hope of the future. For example, evolution’s beautiful theory of the creation of the world offers many perplexing problems to the inquiring mind. Inevitably, a teacher who denies divine agency in Creation, who insists there is no intelligent purpose in it, will [infect] the student with the thought that all may be chance. I say, that no youth should be so led without a counter-balancing thought. Even the skeptic teacher should be fair enough to see that even Charles Darwin, when he faced this great question of annihilation, that the Creation is dominated only by chance wrote: “It is an intolerable thought that man and all other sentient beings are doomed to complete annihilation after such long, continued slow progress.”

And another good authority, Raymond West, said, “Why this vast [expenditure] of time and pain and blood?” Why should man come so far if he’s destined to go no farther? A creature that travels such distances and fought such battles and won such victories deserves what we are compelled to say, “To conquer death and rob the grave of its victory.” The public school teacher will probably, even if he says that much, will go no farther. In the Church school the teacher is unhampered. In the Brigham Young University and every other church school the teacher can say God is at the helm. God is the Creator of the earth, He’s the Father of our souls and spirits. No question about it. You have your testimony — if you haven’t you shouldn’t be on the faculty. Fosdick said that “Perpetuation of personality is the highest thing in creation.” Church school teachers can add the Lord revealed to Prophet Joseph Smith the sublime truth: “This is my work and glory. To bring to pass the immortality and eternal life of man” (Moses 1:39).



**President David O. McKay: Honest Convictions Can Be Expressed, 1956<sup>14</sup>**

And now I have just time to comment on the opportunity of the BYU to teach these fundamental truths. This thought was expressed by Dr. Sidney B. Sperry in the opening prayer, that here in this school [BYU], destined to become the greatest in the world, opportunities are given to guide students in this higher quality of life, this guide, this anchor, this cord leading into the depths of the forest. Whatever the subject may be, the principles of the gospel of Jesus Christ may be elaborated upon without fear of anyone's objecting, and the teacher can be free to express his honest conviction regarding it, whether that subject be in geology, the history of the world, the millions of years that it took to prepare the physical world, whether it be in engineering, literature, art — any principles of the gospel may be briefly or extensively touched upon for the anchoring of the student who is seeking to know the truth.

**President Harold B. Lee: Finding Answers in the Scriptures, 1972<sup>15</sup>**

I was somewhat sorrowed recently to hear someone, a sister who comes from a church family, ask, “What about the pre-Adamic people?” Here was someone who I thought was fully grounded in the faith.

I asked, “What about the pre-Adamic people?”

She replied, “Well, aren’t there evidences that people preceded the Adamic period of the earth?”

I said, “Have you forgotten the scriptures that says, ‘And I, the Lord God, formed man from the dust of the ground, and breathed into his nostrils the breath of life; and man became a living soul, the first flesh upon the earth, the first man also ...’” (Moses 3:7.) I asked, “Do you believe that?”

She wondered about the creation because she had read the theories of the scientists, and the question that she was really asking was: How do you reconcile science with religion? The answer must be, If science is not true, you cannot reconcile truth with error.

Missionaries going out into the field often ask how we reconcile the teachings of the scriptures with the teachings of the scientists in accordance with the temple ordinances. In reply I occasionally refer to the revelation given to the Prophet Joseph Smith in Kirtland in 1833, concerning the great event that is to take place at the commencement of the millennial reign when the Lord shall come; the Lord said:

Yea, verily I say unto you, in that day when the Lord shall come, he shall reveal all things—

Things which have passed, and hidden things which no man knew, things of the earth, by which it was made, and the purpose and the end thereof—

Things most precious, things that are above, and things that are beneath, things that are in the earth, and upon the earth, and in heaven.” (D&C 101:32–34)

Then I say, “If you and I are there when the Lord reveals all this, then I’ll answer your questions — how the earth was made, how man came to be placed upon the earth. Until that time till we have is the support and security that we have in the scriptures, and we must accept the rest by faith.”

President Joseph F. Smith said: “Our young people are diligent students. They reach out for truth and knowledge with commendable zeal, and in so doing they must necessarily adopt for temporary use, the theories of men. As long, however, as they recognize them as scaffolding useful for research purposes, there can be no special harm in them. It is when these theories are settled upon as basic truth that trouble appears, and the searcher then stands in grave danger of being led hopelessly from the right way.” (*Gospel Doctrine* [Deseret Book Co., 1939], p. 38.)

Dr. Henry Eyring, one of our great scientists, in a class that I was privileged to attend some years ago, was asked, “Dr. Eyring, why hasn’t the Lord explained how

these things came about?” And he said something to the effect, as I remember — “Well, I suppose it would be like trying to explain the theory of atomic energy to an eight-year-old child. The eight-year-old child couldn’t understand it. Until we come to an understanding, we will have to depend solely upon what the Lord has said.”

Dr. Eyring has written: “I have often met this question: ‘Dr. Eyring, as a scientist, how can you accept revealed religion?’ The answer is simple. The Gospel commits us only to the truth. The same pragmatic tests that apply in science apply to religion. Try it. Does it work? The conception of a God ruling in the universe and concerned with how it works is impossible for me without the corollary that He should be interested in man, the most remarkable phenomenon in the world. Being interested in man, it is natural that He would provide a plan for man’s development and welfare. This plan is the Gospel of Jesus Christ.

“... The Gospel is indeed the plan which the Creator of the universe has devised to guide His children and bring them back to Him. Through the ages, He has chosen from among His worthy sons prophets to act as guides to His children. Today, The Church of Jesus Christ of Latter-day Saints is presided over by good and wise men who instruct and counsel those who have the wisdom to listen.” (*The Faith of a Scientist* [Bookcraft, 1967], pp. 103–104.)

**President Spencer W. Kimball: Creation of Adam and Eve, 1976<sup>16</sup>**

The Creators breathed into their nostrils the breath of life and man and woman became living souls. We don't know exactly how their coming into this world happened, and when we're able to understand it the Lord will tell us.

**President Ezra Taft Benson: Worldly Trends and Teachings, 1988<sup>17</sup>**

*Statement a.* Our families may be corrupted by worldly trends and teachings unless we know how to use the book (Book of Mormon) to expose and combat the falsehoods in socialism, organic evolution, rationalism, humanism, etc.

*Statement b.* Our families may be corrupted by worldly trends and teachings unless we know how to use the book to expose and combat the falsehoods in socialism, rationalism, etc.

**John L. Sorenson: Origin of Man, 1991<sup>18</sup>**

The view of the “origin of man” in The Church of Jesus Christ of Latter-day Saints differs significantly from that in most other modern traditions. Its prime concern is to affirm that humans were created as spirits by and in the image of God, which determined their form and nature long before they became earthly organisms. Questions about what biological or cultural mechanisms might have produced *Homo sapiens* and over what period of time that often dominate secular discussions are of limited interest for Latter-day Saints.

The clearest presentation of the Church position may be a 1909 statement by the First Presidency entitled “The Origin of Man,” where four essential points are made: (1) God created humans (Genesis 1:26-27); (2) God created Adam, “the origin of the human family” and “the first man”; (3) creation was sequential: first spiritual, later physical; and (4) each human body displays the characteristics of the individual premortal spirit that inhabits it. Other ideas included in the statement are that humanity was not “a development from the lower orders of creation” but a “fall” from a higher state of existence; that an understanding of all the details about the origin of man is not vital to one’s salvation, although the matter is related to several important truths; that the subject cannot be fully clarified by human learning alone; and that only certain relevant facts are now known, to which the Church adheres.

Subsequent official statements indicate that the details of how Adam became “the first man” [Moses 3:7; Abraham 1:3] are considered not to have been revealed clearly enough to settle questions of process. Emphasized instead is an eternal perspective wherein the individual as an “undeveloped offspring of celestial parentage is capable, by experience through ages and aeons, of evolving into a God” ([*Improvement Era*] 28:1091).

Since the rise of Darwinism in 1860, individual Latter-day Saints, both leaders and members, have occasionally participated in public discussion about evolution, since the official position of the Church on man’s origin is not definitive in all respects. Mormons have expressed a wide range of views that are reminiscent of the well-known debates among Christians. Since a large number of Latter-day Saints entered careers in science early in this century, some have attempted to reconcile scientific facts and ideas with statements from the scriptures and prophetic leaders that are emphasized in the LDS tradition. Others have argued that in this area science merely offers “theories of men” and should therefore be discounted.

Many sympathetic to science interpret certain statements in LDS scripture to mean that God used a version of evolution to prepare bodies and environmental surrounding suitable for the premortal spirits. For example, one scriptural description of creation says, “the Gods *organized the earth to bring forth ...* every thing that creepeth upon the earth after its kind” (Abraham 4:25 [emphasis added]). Certain statements of various General Authorities are also used by proponents of this idea to justify their opinions.

Other Latter-day Saints accept a more literal reading of scriptural passages that suggest to them an abrupt creation. Proponents of this view also support their positions with statements from scripture and General Authorities.

While the current state of revealed truth on the LDS doctrine of man's origin may permit some differences of opinion concerning the relationship of science and religion, it clearly affirms that God created man, that the fall of Adam was foreknown of God and was real and significant, and that the Atonement of Christ was foreordained and necessary to reverse the effects of the Fall. Perhaps because these claims embrace the main doctrinal issues relevant to the condition of man, the description of the actual creation process does not receive much attention from the general membership of the Church or from the authorities.

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**President Gordon B. Hinckley: Organic Evolution, 1997<sup>19</sup>**

People ask me every now and again if I believe in evolution. I tell them I am not concerned with organic evolution. I do not worry about it. I passed through that argument long ago.



**Hinckley, Gordon B. The Origin of Man, 2002<sup>20</sup>**

What the Church requires is only belief “that Adam was the first man of what we would call the human race,” says Gordon Hinckley, the church’s living prophet. Scientists can speculate on the rest, he says, recalling his own study of anthropology and geology: “Studied all about it. Didn’t worry me then. Doesn’t worry me now.”

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### Endnotes

1. The BYU Packet on Evolution and the Origin of Man, along with additional statements, has been published previously with commentary in W. E. Evenson et al., *Mormonism and Evolution*.
2. J. R. Clark, *Messages*, 4:199-200.
3. See *ibid.*, 4:199-206.
4. See *ibid.*, 5:243.
5. W. E. Evenson, *LDS Doctrine*, p. xxxi.
6. B. H. Roberts, *The Truth*.
7. W. E. Evenson, in B. H. Roberts, *The Truth*, p. cxxiii.
8. W. E. Evenson, *Counsel Valid*.
9. B. Young, *Collected Discourses*, Brigham Young Office Journals, 27 December 1859, 3:1531. It is not clear how this statement about the oneness of the human species and the animal kingdom should be reconciled with President Young's belief, expressed elsewhere, that Adam's body "was begotten by *his Father* in heaven" (B. Young, 9 April 1852, p. 50. Cf., e.g., J. Smith, Jr., 1903 reminiscence of B. F. Johnson cited in E. D. LeBaron, *Benjamin F. Johnson*, p. 230; J. F. Smith in J. R. Clark, *Messages of the First Presidency*, 4:266-267; J. F. Smith, *Gospel Doctrine*, p. 62). Hugh Nibley observed: "Brigham Young recognized that many people were not prepared to understand the mysteries of God and godhood. 'I could tell you much more about this,' he said, speaking of the role of Adam, but checked himself, recognizing that the world would probably misinterpret his teaching" (H. W. Nibley, *BY Teachings*, p. 1610. See B. Young, 9 April 1852, p. 51). It is

certain, however, that President Young believed that Adam was not fashioned by hand from the dust of the earth as one would create a brick. Instead, he asserted: “He was made as you and I are made, and no person was made upon any other principle” (B. Young, 20 April 1856, p. 420).

In a letter to his son Willard on October 19, 1876, President Young wrote (Brigham Young, *My Dear Son*, p. 199):

We have enough and to spare, at present in these mountains, of schools where young infidels are made because the teachers are so tender-footed that they dare not mention the principles of the gospel to their pupils, but have no hesitancy in introducing into the classroom the theories of Huxley, of Darwin, or of Miall and the false political economy which contends against co-operation and the United Order. This course I am resolutely and uncompromisingly opposed to, and I hope to see the day when the doctrines of the gospel will be taught in all our schools, when the revelation of the Lord will be our texts, and our books will be written and manufactured by ourselves and in our own midst. As a beginning in this direction I have endowed the Brigham Young Academy at Provo and [am] now seeking to do the same thing in this city.

Other statements by President Young make it clear that he did not oppose the claims of science and scholarship generally, specifically including the ideas of a very old earth, the presence of figurative symbolism the Bible stories of Creation, and a biological affinity between man and the animals. His complaint above is that theories of all kinds are presented openly in local classrooms while at the same time teachers are hesitant to mention the principles of the Gospel. Hence, his motive in creating an academy where the Gospel can be taught vigorously alongside all other subjects. His desire was have a school where, as Karl G. Maeser famously remembered it, “neither the alphabet nor the multiplication table should be taught without the Spirit of God” (K. G. Maeser, *History of the Academy*, 2. For other statements by Brigham Young on the importance of merging the spiritual and the temporal in education, see A. L. Richards, *Called to Teach*, pp. 360-363). Incidentally, according to his biographer, Maeser himself “did not oppose evolution as a theory unless it was claimed to be a ‘final cause,’ replacing the Creator” (ibid., p. 551).

Note that the mention of “Miall” in the quote from Brigham Young above refers to Edward Miall (1829-1881), “the staunch advocate of the British Anti-State-Church Association” (ibid., p. 384 n. 14).

10. J. Taylor, *Mediation and Atonement*, pp. 164-165.
11. J. F. Smith et al., *Editorial*. President Joseph F. Smith and Edward H. Anderson served as editors for the *Improvement Era* at this time. The editorial was prepared in reply to questions from “several High Priests’ quorums,” where the 1909 statement of the First Presidency had no doubt been a subject of continuing discussion. Moreover, the 1910 Manual for the Priests Quorum prepared by

Elder B. H. Roberts had contained the following statement, which also may have engendered questions (B. H. Roberts, *Divine Mission*, Lesson 14 — The Creation of Man, p. 35):

Man has descended from God; in fact, he is of the same race as the Gods. His descent has not been from a lower form of life, but from the Highest Form of Life; in other words, man is, in the most literal sense, a child of God. This is not only true of the spirit of man, but of his body also.

12. J. F. Smith, *Philosophy*. Although the *Improvement Era* editorial is unsigned and could have been initially prepared by co-editor Edward H. Anderson, the other editor of the publication was President Joseph F. Smith, who normally would have at least reviewed such articles (D. E. Jeffery, *We Don't Know*, p. 32).

“In the latter part of 1910, the questions of academic freedom and curriculum content in the Church school system came into critical focus. ... ‘Higher criticism’ and ‘evolution’ were the subjects of stated concern, ... four professors were eventually terminated at BYU, and President Joseph F. Smith undertook to explain the matter to the Church in editorials in the April 1911 issues of the *Era* and the *Juvenile Instructor*” (ibid., pp. 32-33). The focus of President Smith’s statement is the observation that the preferred emphasis of Church schools at the time was to be the “industrial and practical side of education.” With respect to the topic of evolution, he makes it clear that “in reaching the conclusion that evolution would be best left out of discussions in our Church schools” it was a “question of propriety” and not a matter of saying “how much of evolution is true, or how much is false. ... The Church itself has no philosophy about the *modus operandi* employed by the Lord in His creation of the world, and much of the talk therefore about the philosophy of Mormonism is altogether misleading.”

Since 1911, the academic mission of Church schools has understandably broadened beyond its initial more wholly vocational focus. The first formal class in evolution was instituted at BYU in the fall of 1971 with the First Presidency’s approval, and is currently a required part of the core curriculum of all BYU students in the biological sciences. Evolutionary biology (see Biology) has since become “one of the largest and most successful graduate programs at BYU” (M. R. Ash, *Myth*, pp. 32-33), with professors publishing in major evolutionary conferences and journals. See T. L. Givens, *Paradox*, pp. 209-210, 378-379 nn. 59-64 for a brief summary of efforts of Mormon scientists that “not only incorporate evolutionary science, but break new ground in the field.” Elsewhere Givens specifically cites the contributions of Keith Crandall, Michael Whiting, and Jack Sites in molecular evolution, noting that all three are “major players in the National Science Foundation’s ‘Tree of Life’ project” (T. L. Givens, *Wrestling*, p. 369 n. 132). Given adds: “Neither Creationism nor Intelligent Design find a home in the science departments of the LDS-owned school” (T. L. Givens, *Wrestling*, p. 219).

13. D. O. McKay, Message. During the previous two years, President McKay had responded to several inquiries about the official position of the Church regarding evolution and the age of the earth (G. A. Prince et al., *McKay*, pp. 45-49).
14. D. O. McKay, Anchor. With respect to what should be taught in public school classrooms, the Church has declined to take part in any debate of the issue, and an effort to require the schools to teach that not all scientists agree about the origin of life was soundly defeated in the Utah legislature in 2006 (E. Jarvik, *Beliefs*).
15. H. B. Lee, Find the Answers, pp. 2-3.
16. Church Educational System, *Religion 327*, p. 9; S. W. Kimball, Blessings.
17. During his apostolic years, President Ezra Taft Benson publicly stated his concerns about the theory of evolution on several occasions. For example, the following statement from the October 1970 General Conference was reprinted in 1975 and 1988 within a collection of his teachings (E. T. Benson, *Loyalties*, p. 225; E. T. Benson, *Teachings 1988*, p. 307):

As a watchman on the tower, I feel to warn you that one of the chief means of misleading our youth and destroying the family unit is our educational institutions. President Joseph F. Smith referred to false educational ideas as one of the three threatening dangers among our Church members. There is more than one reason why the Church is advising our youth to attend colleges close to their homes where institutes of religion are available. It gives the parents the opportunity to stay close to their children, and if they become alerted and informed, these parents can help expose some of the deceptions of men like Sigmund Freud, Charles Darwin, John Dewey, Karl Marx, John Keynes, and others.

*Statement a* was first given part of a General Conference address of April 1975 that was given while President Benson was an apostle. It was published in the *Ensign* at the time (E. T. Benson, *Book of Mormon Is the Word of God 1975*, p. 65), but is included here because it was published again with no changes during his presidency (E. T. Benson, *Witness and a Warning*, p. 6).

*Statement b* is taken from a different version of the same talk. When the talk was republished in the *Ensign* during President Benson's administration in 1988, the specific references to organic evolution and humanism were omitted (E. T. Benson, *Book of Mormon Is the Word of God 1988*, p. 5).

18. J. L. Sorenson, Origin.
19. G. B. Hinckley, Ogden Institute, p. 379. On 15 April 1997, President Gordon B. Hinckley delivered this speech to students at the LDS Institute in Ogden, Utah. "The speech is a series of responses to students' questions, exhorting them to good living and high commitments, building to a response about evolution, and then to personal testimony. A variety of interpretations can be sustained

in the context of the overall speech; we suggest readers consult the speech in its entirety. The kernel statement about evolution is given here” (W. E. Evenson et al., *Evolution*, p. 108).

In a 1978 address he gave as an apostle, Gordon B. Hinckley said (“Four imperatives for Religious Educators,” Church Educational System Address, September 15, 1978, reprinted in part in G. B. Hinckley, *Teachings 1997*, p. 298):

None of us ... knows enough. The learning process is an endless process. We must read, we must observe, we must assimilate, and we must ponder that to which we expose our minds. I believe in evolution, not organic evolution, as it is called, but in the evolution of the mind, the heart, and the soul of man. I believe in improvement. I believe in growth.

20. G. B. Hinckley, 2002, cited in L. A. Witham, *Darwin*, p. 177 and reprinted in E. Jarvik, *Beliefs*. President Hinckley made this remark in an interview with Larry A. Witham, who assured authors Evenson and Jeffery that the statement “was accurately transcribed from his tape-recorded interview” (W. E. Evenson et al., *Evolution*, p. 110).



# DAVID H. BAILEY



David H. Bailey is a mathematician and computer scientist. He recently retired from the Lawrence Berkeley National Laboratory, but is still a very active research scientist. He has published six books and over two hundred technical papers on topics such as high-performance scientific computing, computational mathematics, financial mathematics, and computational biology. He has received the Sidney Fernbach Award from the IEEE Computer Society, the Gordon Bell Prize from the Association for Computing Machinery, and the Chauvenet and Merten Hesse Prizes from the Mathematical Association of America — the only person to have received major awards from each of these three professional societies.

Bailey is a strong believer in rigorous standards of ethics and reproducibility in scientific research. In 1991, concerned about lax standards in the field of high-performance computing at the time, Bailey wrote papers highlighting questionable practices and proposing more rigorous standards to analyze performance. In November 2015, one of these papers was recognized with the Test of Time Award from the ACM/IEEE Supercomputing Conference for its enduring impact on the field. More recently, he has also written about the lack of rigorous standards in the financial mathematics field, and has proposed new techniques and methodologies to ensure responsible research in the field.

Bailey has also written extensively on topics of science and religion in general, and on science and Mormonism in particular. He is the editor of the website [ScienceMeetsReligion.org](http://ScienceMeetsReligion.org), which includes articles on topics such as evolution, geology, physics, cosmology, and how the awe-inspiring developments in these fields can be seen to be in harmony with modern, enlightened religion.

Bailey and his wife, Linda, live in Alamo, California. He served as a full-time missionary in the Hong Kong-Taiwan Mission, and currently teaches the High Priests Quorum. Linda volunteers at the Oakland Family History Center. They have four married daughters and seven grandchildren.



# EMILY BATES



Emily Bates earned her Bachelors of Science in Biology at the University of Utah, where she studied the genetics of development. She then served a full-time mission for The Church of Jesus Christ of Latter-day Saints in Geneva, Switzerland.

After her mission, she earned her Ph.D. in genetics at Harvard Medical School. Her thesis work identified potential therapeutic targets for neurodegenerative disease, focusing on Huntington's Disease. Dr. Bates spent a year teaching at Harvard University as a teaching fellow for molecular biology, cellular biology, and biological anthropology and serving as a resident tutor. She completed her postdoctoral research at UCSF School of Medicine and was part of the team to identify a genetic cause for migraine headaches.

Dr. Bates taught Chemistry and Biochemistry at Brigham Young University in Provo, Utah for four years. She is currently a member of the research faculty at the University of Colorado Denver School of Medicine in the Department of Pediatrics.



# DAVID M. BELNAP



David Michael Belnap was born in Ixelles, Belgium. His American parents, Parley and Bona Belnap, were in Belgium while his father was working on a graduate degree in music at the Royal Flemish Conservatory in Antwerp. David grew up primarily in Provo and American Fork, Utah. Up through his elementary school years, he also lived in London; Ann Arbor, Michigan; Boulder, Colorado; and Salzburg, Austria—as his father did additional graduate studies and other work assignments. When David was ten years old, his family moved from Provo to American Fork, to a home with a large backyard. There, David and his parents, brothers, and sister spent many hours tending a very large garden and several animals. It was a wonderful way to grow up. Weeding the garden provided him and his siblings a lot of time to think. Growing up, David loved camping and hiking in the desert and mountains. He graduated from American Fork High School in 1981. David served a mission for The Church of Jesus Christ of Latter-day Saints in the Cleveland, Ohio area. He also served as an enlisted member of the Army National Guard in Utah and Indiana from 1982 through 1989, completing his service at the rank of staff sergeant. After returning from his mission, David attended Brigham Young University, receiving a BS degree in biochemistry in April 1989. That summer he began graduate studies at Purdue University, where he earned a PhD in biology in 1995.

While at Purdue University, David began studying the structure of viruses primarily by three-dimensional electron microscopy (3DEM). He has continued this research to the present day. He has published work on papillomaviruses (human, rabbit, and bovine), polyomaviruses (human, mouse, simian, and avian), poliovirus, hepatitis B virus, herpes simplex virus, and bacteriophages (bacterial viruses). David has also published papers on other biological macromolecules and 3DEM methods. He helped establish conventions for 3DEM work, and this aided the development of the EM Data Bank, an internet resource for 3DEM data. Following graduate studies, David worked at the National Institutes of Health in Bethesda, Maryland from 1995 to 2004 and Brigham Young University from 2004 to 2012. He currently is a research faculty member in the Departments of Biochemistry and Biology at the University of Utah, where he also directs the Electron Microscopy Core Laboratory.

David married Julie Hasting in the Salt Lake Temple in 1986. They are the parents of four daughters and one son, and the grandparents of four. David and Julie have enjoyed each place they have lived and have especially appreciated the gospel insights they have learned and Christ-like love they have felt from associating with brothers and sisters in the church, good neighbors, and friends. David enjoys serving in his church responsibilities. He has served in teaching, leadership, and secretarial positions. He has especially enjoyed working with youth in Scouting and Sunday School. David enjoys gardening, playing sports, cycling, running, reading, and especially anything outdoors with his wife and family.



# JEFFREY M. BRADSHAW



Jeffrey M. Bradshaw (PhD, Cognitive Science, University of Washington) is a Senior Research Scientist at the Florida Institute for Human and Machine Cognition (IHMC) in Pensacola, Florida ([www.ihmc.us/groups/jbradshaw](http://www.ihmc.us/groups/jbradshaw); [en.wikipedia.org/wiki/Jeffrey\\_M.\\_Bradshaw](http://en.wikipedia.org/wiki/Jeffrey_M._Bradshaw)). His professional writings have explored a wide range of topics in human and machine intelligence ([www.jeffreymbradshaw.net](http://www.jeffreymbradshaw.net)). From 1985 to 2000, Bradshaw led research groups at The Boeing Company. Jeff is an Honorary Visiting Researcher at the University of Edinburgh, a former Visiting Professor at the Institut de Cognitique at the University of Bordeaux, and a member of the Graduate Faculty, Human-Centered Design Institute of the Florida Institute of Technology.

Jeff helped pioneer the research area of multi-agent systems, and his first book on the topic, *Software Agents*, became a classic in the field and a best-seller for The MIT Press. In addition, Jeff's group at IHMC conducts research topics such as digital policy, identity management, semantic technologies, cyber sensemaking, self-driving cars, and visualizations that exploit principles of human perception and cognition. Results have been applied to scores of commercial and government applications. Jeff has organized a series of Human-Agent-Robot Teamwork (HART) workshops. He chairs the Scientific Advisory Council for the Nissan Research Center—Silicon Valley and co-edits the Human-Centered Computing Department for *IEEE Intelligent Systems*.

Jeff has been the recipient of several awards and patents and has been an adviser for weighty initiatives in science, defense, space, industry, and academia worldwide. He was a member of the Defense Science Board 2015 Study on Autonomy, the Board on Global Science and Technology for the National Academies of Science, and the National Research Council Committee on Emerging Cognitive Neuroscience Research. He is former chair of ACM SIGART (now SIGAI) and the RIACS Science Council for NASA Ames. He was a scientific advisor to the Cognitive Science Program at Sandia National Laboratories, the HCI and Visualization program at the German Research Center for Artificial Intelligence (DFKI), and to the Japanese NEC Technology Paradigm Shifts initiative. He received the Web Intelligence Consortium Outstanding Contributions Award.

Jeff has an abiding interest in Genesis, temples, and the ancient Near East ([www.templethemes.net](http://www.templethemes.net)). He has lectured at BYU Campus Education Week, the Sidney B. Sperry Symposium, and at FairMormon meetings. He has published commentaries on the book of Moses and JST Genesis 1-11, and other volumes on temple-related topics. His articles have appeared in *Studies in the Bible and Antiquity*, *Element: A Journal of Mormon Philosophy and Theology*, *Interpreter: A Journal of Mormon Scripture*, *Meridian Magazine*, and *BYU Studies*. He is a vice president for The Interpreter Foundation and is on the Advisory Board for the Academy for Temple Studies.

Jeff was a missionary in France and Belgium from 1975-1977, and his family has returned twice to live in France: once from 1993-1994 as a Fulbright Scholar and a second time from 2005-2006 as an unexpected "sabbatical" in the aftermath of Hurricane Ivan. Jeff has served twice as a bishop and twice as a counselor in the stake presidency of the Pensacola Florida Stake. He and his wife, Kathleen, are the parents of four children and nine grandchildren. In 2016, they accepted a call to serve in the Democratic Republic of Congo, Kishasa Mission.





## R. PAUL EVANS



R. Paul Evans joined the BYU faculty as a molecular biologist in the College of Biology and Agriculture (now known as the College of Life Sciences) 29 years ago. Previously he was a research fellow at Purdue University and received his PhD in 1983 from the Medical College of Virginia at Virginia Commonwealth University and BS from BYU in 1995 (this is not a typo).

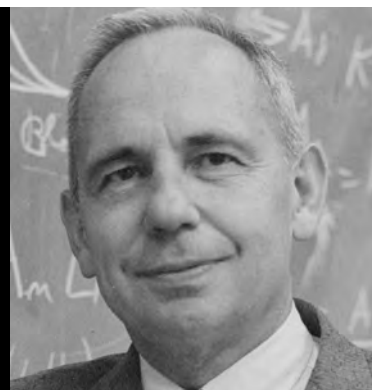
His greatest joy is his best friend and companion, Jaelyn Bartyn Evans. They met in Camarillo, California and have been married for 38 years with two daughters, Crystal Ann and Cambria. He is the oldest of the seven children of Richard and Patty Evans of Vienna, Virginia.

Paul's research at BYU has centered on using DNA to study the changes that occur in families, populations, and species over time. Working with international, federal, and state agencies, he and Dennis Shiozawa have defined the genetic identity of fishes and aquatic insects throughout the world. Other projects have involved lobster populations along the coast of Oman, penguin colonies in the Antarctic, water snake families in Texas, and most recently, thorny headed parasites. In the course of the river related work, he has been "required" to raft through much of the white water and rapids of the western United States, including a month of rafting, collecting, and yes, "working" in the Grand Canyon.

In 1994, Paul was perfecting techniques to recover DNA from fish bones recovered at archaeological sites. One day, Wilfred Griggs walked into his office and asked, "If you can get DNA from fish bones, can you get DNA from the bones of Egyptian mummies?" Since then he has excavated in Egypt during ten seasons and is the team's resident biologist performing forensic pathology, age/gender determination, and anything else biology.



# HENRY EYRING



Henry Eyring (February 20, 1901 – December 26, 1981) was a Mexican-born American theoretical chemist whose primary contribution was in the study of chemical reaction rates and intermediates.

A prolific writer, he authored more than six hundred scientific articles, ten scientific books, and a few books on the subject of science and religion. He received the Wolf Prize in Chemistry in 1980 and the National Medal of Science in 1966 for developing the Absolute Rate Theory or Transition state theory of chemical reactions, one of the most important developments of 20th-century chemistry. Several other chemists later received the Nobel Prize for work based on it, and his failure to receive the Nobel was a matter of surprise to many. Other awards included: AAAS Newcomb Cleveland Prize (1932), Bingham Medal (1949) of the Society of Rheology, Peter Debye Award in Physical Chemistry (1964), National Medal of Science (1966), Irving Langmuir Award (1967), Linus Pauling Award (1969), Elliott Cresson Medal (1969) from the Franklin Institute, Golden Plate Award (1974), T. W. Richards Medal (1975), Priestley Medal (1975), Berzelius Medal (1979). Eyring was a member of the International Academy of Quantum Molecular Science. He was elected president of the American Chemical Society in 1963 and the Association for the Advancement of Science in 1965. Eyring authored, co-authored, or edited twenty-three professional books or journals, and three religious books.

Eyring was a member of the LDS Church throughout his life. His views of science and religion were captured in this quote: “Is there any conflict between science and religion? There is no conflict in the mind of God, but often there is conflict in the minds of men.” He served as a branch president, district president, and, for over twenty years, a member of the general board of the Deseret Sunday School Union.

Eyring married Mildred Bennion. She was a native of Granger, Utah, who had a degree from the University of Utah and served as head of the physical education department there. She met Eyring while pursuing a doctorate at the University of Wisconsin. They had three sons together. The oldest, Edward M. “Ted” Eyring is an emeritus professor of chemistry at the University of Utah. Henry B. Eyring is an apostle and current counselor in the First Presidency of the Church. Harden B. Eyring is a higher education administrator for the State of Utah.



# RON HELINGS



Ron Hellings was born and raised in Pasadena, California. After serving two and a half years in the French East and Franco-Belgian missions, he returned to marry his sweetheart, Dee, and complete a BS in Physics at BYU, an MS at UCLA, and a PhD at Montana State University-Bozeman.

Ron has taught Physics at Southern Oregon University, University of Nevada-Las Vegas, Cal Poly-Pomona, Harvey Mudd College, and Pomona College. He spent twenty-five years as a Research Scientist at NASA's Jet Propulsion Laboratory before moving back to Bozeman in 2001 to work as a Research Professor in the Physics Department. For a period of three years during his time at Montana State University, he was on loan to NASA Headquarters in Washington, DC, to act as Program Scientist for the Astrophysics Theory Program.

Ron's research interests are alternative theories of gravity, experimental relativity, solar system dynamics, gravitational wave astronomy, pulsar timing, and relativistic cosmology.

Ron is basically a Gospel Doctrine teacher, having spent most of his adult life in that calling in various wards. He recently served as bishop of the Bozeman University Ward and is currently a member of the High Council in his stake. Ron and Dee have three children and four grandchildren.

Ron has written a testimony on [MormonScholarsTestify.org](http://MormonScholarsTestify.org). There he points out that he is a skeptic. He says that he does not recommend that attitude to anyone, but that he cannot help it for himself. He simply cannot believe anything without a good reason. He goes on to explain that even his faith in God is based on only the strongest of evidence. It is based on the fact that he has spoken to God and that God has answered. He knows that this happened, he says, because he was there. And he explains that, for him, all other evidence from any other source must be explained reasonably and in light of the undeniable evidence of those experiences.



# BART J. KOWALLIS



Bart J. Kowallis is associate dean of the College of Physical and Mathematical Sciences and professor of geology at Brigham Young University. Bart grew up in the small, northern Utah town of Pleasant View where he was surrounded by both spectacular mountains and loving family—two things that developed into the great passions of his life: geology and genealogy. He attended Weber High School and Brigham Young University before serving a mission in French-speaking Quebec. Following his mission, Bart finished his undergraduate degree at BYU in 1977 and then attended the University of Wisconsin-Madison where he earned M.S. (1979) and Ph.D. (1981) degrees. He was hired as a faculty member at BYU in January of 1982 and during his 33 years at the university has taught classes in physical geology, geophysics, structural geology, field geology, physical science, and family history.

His research since coming to BYU has focused on geologic mapping, geochronology, stratigraphy, and structural geology, particularly of the Mesozoic rocks in Utah and Tertiary rocks in Mexico. Since 2001, Bart and his students have concentrated their efforts in mapping and studying the rocks exposed along the south and north flanks of the Uinta Mountains in cooperation with the Utah Geological Survey and United States Geological Survey. He is a member of the American Geophysical Union, the American Association of Petroleum Geologists, the Utah Geological Association, and a Fellow of the Geological Society of America. At BYU he has been honored with several teaching awards: an Alcuin General Education Teaching Award (1986), a Karl G. Maeser General Education Professorship (2003), and a Religion Transfer Professor Award (2015).

In addition to publishing over seventy articles and books on geologic topics, Bart has also published on family history and genealogy, as well as an occasional article on issues of science and religion. He has served in a wide variety of LDS Church callings, including: Elders Quorum President, Counselor in an MTC Branch Presidency, Blazer Leader, Scoutmaster, Young Men President, Ward Mission Leader, Counselor in Bishopric, Bishop, High Councilor, Stake Family History Center Director, Provo Temple Ordinance Worker, and most importantly as a Nursery Worker in the Primary. He is married to the former Julee Clark, and they have four wonderful children and one precious granddaughter.





# JOHN S. LEWIS



John S. Lewis is Professor Emeritus of Planetary Sciences and Co-Director of the Space Engineering Research Center at the University of Arizona. He was previously a Professor of Planetary Sciences and Chemistry at MIT. He was a Visiting Associate Professor at California Institute of Technology in 1973 and a Visiting Professor at Tsinghua University in Beijing, PRC for the 2005-2006 academic year.

His research interests are related to the application of chemistry to astronomical problems, including the origin of the Solar System, the evolution of planetary atmospheres, the origin of organic matter in planetary environments, the chemical structure and thermal history of icy satellites, the hazards of comet and asteroid bombardment of Earth, and the extraction, processing, and use of the energy and material resources of nearby space.

He was the first to predict the existence of deep global oceans on the large icy moons of Jupiter and the presence of a radioactive heat source (40K) in Earth's core to power core convection, generate the geomagnetic field, and drive continental drift. He also developed the standard atmospheric and cloud composition models of Venus and the giant planets.

He served on the Board of Directors of American Rocket Company (AmRoc) during the development of hybrid rocket motors for the private launch business, a process that culminated in the use of an AmRoc-designed motor to propel SpaceShipOne to an altitude of over 100 km and win astronaut's wings for its pilots in 2004. He is presently Chief Scientist for Deep Space Industries, an asteroid-mining company.

He has served as a member or Chairman of a wide variety of NASA and National Academy of Sciences (NAS) advisory committees and review panels, spanning topics ranging from planetary exploration and the origin of life to interstellar communication. He has written 19 textbooks and popular science books, has authored over 150 scientific publications, and has given invited lectures at over 100 colleges, universities, and research centers throughout the world.

He and Sister Lewis are converts who joined the Church in 1981. They served for a year at Tsinghua University in Beijing through BYU's China Teachers Program, and served as missionaries for 18 months in the International Zone of the Family History Library in Salt Lake City. They recently returned from the New Zealand Wellington Mission. They have six children and 34 grandchildren. Four of their grandchildren are currently serving missions. He is presently a member of the High Council of Mount Vernon, Washington Stake.



# STEVEN L. PECK



Steven L. Peck is an Associate Professor in the Biology Department of Brigham Young University. He holds a Ph.D. in Biomathematics and Entomology from North Carolina State University; an MS in Biostatistics from the University of North Carolina at Chapel Hill, and a BS in Statistics/Computer Science from Brigham Young University. He uses computer simulation to study ecological and evolutionary processes in insects. He has published over forty scientific papers in such journals as *American Naturalist*; *American Entomologist*; *Biological Theory*; *Biology & Philosophy*; *Ecological Modeling*; *Evolution*; *Life Sciences, Society and Policy*; *Philosophy Study*; *Philosophy & Theory in Biology*; *Proceedings of the National Academy of Science*; and *Trends in Ecology and Evolution*.

He has also been active in the academic study of science and religion with papers in *Zygon: Journal of Science and Religion*. He also recently published a book on faith and science in the Neal A. Maxwell Institute for Religious Scholarship Living Faith series called *Evolving Faith: Wanderings of a Mormon Biologist*.

He is also an award-winning fiction writer. His novel, *The Scholar of Moab*, won best novel of 2011 by the Association of Mormon Letters and was a finalist for the Montaigne Medal, a national award. His novella, *A Short Stay in Hell*, is currently being made into a full-length feature film. He also recently published a book with Zarahemla Books of LDS short stories, *Wandering Realities*, which includes several award-winning stories.

His greatest achievement, however, is he and his wife Lori's four sons and one daughter. He served a mission in the Arkansas Little Rock Mission and currently is the High Priest Instructor for his ward.



# DANIEL C. PETERSON



A native of southern California, Daniel C. Peterson is currently a professor of Islamic studies and Arabic at Brigham Young University (BYU), where, among other things, he has taught courses on Arabic language and literature, Islamic cultural and intellectual history, medieval Islamic and Jewish philosophical texts, the history of the Islamic world before 1800, the religion of Islam, and the Qur'an. He has lectured throughout the Islamic world and on every inhabited continent.

He founded the organization that later became BYU's Middle Eastern Text Initiative (METI). METI publishes dual-language editions of classical texts of medieval Islamic philosophy and science. He led METI until mid-2012.

Peterson has authored, co-authored, or edited several books and many articles on both Islamic and Mormon topics. Among these are *Abraham Divided: An LDS Perspective on the Middle East* (1992) and *Muhammad: Prophet of God* (2007). He writes weekly for the *Deseret News*.

From 1988 through mid-2012, Peterson was deeply involved in the Foundation for Ancient Research and Mormon Studies (FARMS) and its successor organization, the Neal A. Maxwell Institute for Religious Scholarship, eventually chairing the FARMS board of trustees and serving as associate executive director. In 2012, he became the chairman and president of the newly established Interpreter Foundation, which among many other activities, publishes *Interpreter: A Journal of Mormon Scripture*. He has served as President of the Society for Mormon Philosophy and Theology.

Peterson earned a bachelor's degree in Greek and philosophy from Brigham Young University (BYU). Then, after several years of study in Jerusalem and Cairo, he received a doctorate in Arabic and Persian from the University of California at Los Angeles. His dissertation — which united his interests in Plotinian Neoplatonism, ancient and medieval cosmogonic speculations, and Islamic philosophical theology — won a prize from the Middle East Studies Association of North America.

He interrupted his undergraduate studies to represent The Church of Jesus Christ of Latter-day Saints as a missionary in German-speaking Switzerland. The valleys of Lauterbrunnen and Grindelwald — which inspired the elfin valley of Rivendell in J. R. R. Tolkien's works — remain his favorite earthly landscape today.

In 1978, Peterson married Deborah Stephens in the Salt Lake Temple. They are the parents of three sons and the grandparents of one granddaughter.



# JANI RADEBAUGH



Jani Radebaugh is a planetary scientist who specializes in the shapes and origins of landscapes on Earth and other planets in the solar system. She is an Associate Professor of Geological Sciences at Brigham Young University, where she interacts with many students through research and teaching a variety of courses. She obtained her PhD in planetary science from the world-renowned University of Arizona's Lunar and Planetary Laboratory and has been at BYU since 2006.

Jani analyses images of other planets obtained by spacecraft to determine the geologic histories of the surfaces and interiors. She studies landforms on Earth, where it is possible to walk around on them and obtain samples, to gain insight into similar landforms and processes on other planets. Her current investigations include giant sand dunes, mountains, volcanoes, rivers and lakes on Saturn's moon Titan from the currently operating Cassini spacecraft, and she studies actively erupting volcanoes and mountains on Jupiter's moon Io from the Galileo, Cassini, and Voyager spacecraft. She has done field work in the Egyptian Sahara, the Arabian peninsula, the Ethiopian Afar Rift Valley, Australia, the Argentine Altiplano, Hawaii, and the desert southwestern U.S. She is a regular participant in the U.S. Antarctic Search for Meteorites Program, where she spends six weeks at a time in a tent in the deep field, returning with hundreds of meteorites from around the solar system including the Moon and Mars. She seeks to understand how field studies on Earth, including work on big desert dunes and remote volcanoes, as well as meteorite searching in Antarctica, help us better understand processes in the solar system revealed by the myriad spacecraft at other planetary bodies.

Jani communicates the results, excitement, and passion of her research with the public through many avenues. She is a science contributor for the internationally syndicated Discovery Science Channel's *How the Universe Works* seasons 4 and 5. She gave a *TEDxBYU* talk and a BYU-wide forum on "Exploration for Discovery," and she regularly does other radio and public speaking events. She presents at the Spacefest convention, which draws most of the Apollo and Skylab and some space shuttle astronauts and their fans. Reconciliation of Jani's scientific and religious leanings began while she was a student at BYU, mainly under the tutelage of her geology professors, and now she continues to help educate students on the same path.

Jani was born and raised in the church and has five younger siblings and fourteen nieces and nephews. She has worked in a variety of church callings and has enjoyed attending church in many different countries. Jani is part of the church's diverse and talented singles community and has enjoyed the many singles wards she has been privileged to serve in throughout her life.





# GREGORY L. SMITH



Gregory Smith studied research physiology and English at the University of Alberta but escaped into medical school before earning his bachelor's degree. After receiving his MD, he completed his residency in family medicine at St. Mary's Hospital in Montréal, Québec. There he learned the medical vocabulary and French Canadian slang that he didn't pick up in the France Paris Mission and won the Mervyn James Robson Award for Excellence in Internal Medicine.

He now practices rural family medicine in Alberta, with interests in internal medicine and psychiatry. A clinical preceptor for residents and medical students, he has been repeatedly honored for excellence in clinical teaching. He holds an appointment as an Associate Clinical Professor of Family Medicine at the University of Calgary. Since 2014 he has served as a community medical director for Alberta Health Services.

A member of FairMormon since 2005, he volunteers as their FairMormon Answers wiki managing editor. He was an associate editor of the *Mormon Studies Review* at BYU's Neal A. Maxwell Institute for Religious Scholarship from 2011–2012. He is currently a member of the Executive Board of The Interpreter Foundation. Smith has a particular research interest in Latter-day Saint plural marriage and has been published in the *FARMS Review*, *Interpreter: A Journal of Mormon Scripture*, and elsewhere on this and other topics.

With twelve years of classical piano training, he is a lifelong audiophile and owns far too many MP3 files. A self-described biblioholic, he would probably be buried in books had he not discovered the Kindle, and is grateful that he didn't have e-books to distract him in medical school.

He lives happily with his one indulgent wife, four extraordinary children, and two cats.



# MICHAEL R. STARK



Michael Stark joined the faculty at BYU in 2001. He teaches anatomy, developmental biology, and neuroscience classes in the Department of Physiology and Developmental Biology. Michael's research focus is on early nervous system development, and his experiments primarily use the chick embryo model. During his tenure at BYU, dozens of undergraduate and several graduate students have been mentored in the Stark Lab, funded mostly through NIH and BYU grants. He and his wife, Susanne, have seven children (two girls, five boys). The family recently spent six months living in Cambridge, England while Michael conducted research at the University of Cambridge in the Department of Physiology, Development and Neuroscience.

Much of Michael's early life was spent in and around the small town of Kimberly, Idaho, where he moved with his family at a young age. His father became very involved in the local agricultural community, eventually turning a small seed production facility into a worldwide supplier of garden seeds. After high school, Michael attended Idaho State University for a year before serving an LDS mission in Thailand. Upon returning, he attended BYU where he received his BS degree in Zoology. Later he earned his MS degree from Idaho State University (Biology), and his PhD from UC Irvine (Developmental and Cell Biology). Michael worked as a postdoctoral fellow at the University of Utah for three years prior to his current appointment at BYU.

Michael was recognized with the BYU Young Scholar Award in the 2006, and awarded the College of Life Sciences Outstanding Research Award in 2010. He received the Physiology and Developmental Department Faculty Achievement Award in 2011, and was selected to organize the LDS Life Science Research Symposium in 2013. In 2014 he was named a Parke-Davis Fellow, which supported his research visit to the University of Cambridge, England. Michael regularly serves as an ad-hoc reviewer for various funding agencies, including NIH, NSF, and UK's BBSRC, and he regularly reviews scientific articles in his field of expertise. For many years he has provided editorial service, such as serving as consulting editor of developmental biology for McGraw-Hill's *Yearbook of Science and Technology*, and as a member of the editorial board for the journal *Developmental Dynamics*. He is the director of the confocal microscope facility at BYU, is a member of the neuroscience faculty, and is currently the chair of curriculum for the Department of Physiology and Developmental Biology. His BYU faculty profile can be found at <http://lifesciences.byu.edu/~mrs97>.



# TRENT D. STEPHENS



Trent Stephens graduated in 1966 from Raft River High School, Malta, Idaho. He served a mission to the Great Lakes (1967-1969) and then married Kathleen Brown in 1971. He graduated from Brigham Young University in 1973 with a BS in Microbiology and a BS in Zoology. He earned an MS in Zoology from BYU in 1974 and a PhD in Anatomy from the University of Pennsylvania in 1977. He completed a post doc in Pediatrics at the University of Washington in 1981 and took a position teaching Anatomy and Developmental Biology in the Idaho Dental Education Program at Idaho State University the same year. He retired in 2011 after teaching at ISU for thirty years. However, he continues to teach Gross Anatomy every year to the dental students and PA students. He was selected as the ISU Distinguished Teacher (1992) and Outstanding Researcher (2000).

Trent's research is the study of normal and abnormal biological form, including birth defects. He has published approximately one hundred papers and books on the subject, including several scholarly works on the relationship between birth defects and medieval beliefs. He has been building toy and model castles for forty years. He has a castle website ([buildmodelcastles.com](http://buildmodelcastles.com)) and has been teaching classes about the history of castle construction, life in medieval castles, and the modeling of medieval castles for over twenty years. With his daughter Brittani Hobson and niece Carrie Reed, he is launching a huge international party website called Frolic Parties.

Trent has authored or co-authored about twenty books, including several leading-selling Anatomy and Physiology textbooks and the critically acclaimed history of thalidomide (Stephens and Brynner, *Dark Remedy: The Impact of Thalidomide and Its Revival as a Vital Medicine*, Cambridge, MA: Perseus Books, 2001). Trent is considered one of the world's leading authorities on thalidomide, and has been invited to speak at several international conferences. Beginning in 2012, he has functioned as an expert consultant to several law firms and has helped identify over 200 thalidomide victims (now in their early 50s) in Australia, New Zealand, the UK, and the US. He has also coauthored books on the relationship between science and religion (Stephens, Meldrum, and Peterson, *Evolution and Mormonism: A Quest for Understanding*, SLC, Utah: Signature Books, 2001; Meldrum and Stephens, *Who Are the Children of Lehi? DNA and the Book of Mormon*, SLC, Utah: Kofford, 2007).

Trent is an Eagle Scout and Silver Beaver awardee (1991). He served for many years as Cubmaster and Scoutmaster. He has been an Elders Quorum President and has taught Gospel Doctrine, Teacher Development, and Family History courses. He has served as a counselor in a bishopric and as bishop twice. He has served on a High Council and as High Priest Group Leader. He has also been a temple worker in the Idaho Falls Temple.



# JAMES E. TALMAGE



James Edward Talmage (September 21, 1862 – July 27, 1933) was a member of the Quorum of the Twelve Apostles of The Church of Jesus Christ of Latter-day Saints from 1911 until his death. From 1924 to 1928, he served as president of the church's European Mission.

He was born and raised in Hungerford, Berkshire, England. In Provo, he studied the Normal Course at Brigham Young Academy (BYA), with Karl G. Maeser as one of his teachers; he graduated in 1880. In 1881, Elder Talmage received a collegiate diploma from BYA's Scientific Department, the first such diploma to be issued. His early predilection was for the sciences, and in 1882 and 1883 he took selected courses in chemistry and geology at Lehigh University in Bethlehem, Pennsylvania. Though a special student and not a candidate for a degree, during his single year Elder Talmage passed nearly all the examinations required in the four-year course; he graduated and in 1883 and 1884 he was engaged in advanced work at Johns Hopkins University in Baltimore, Maryland. He received a B.S. degree from Lehigh University in 1891 and a Ph.D. from Illinois Wesleyan University for nonresident work in 1896.

Elder Talmage taught science at BYA both before and after he went to study in the eastern United States. He was the president of Latter-day Saints' University until 1894 and then was president of the University of Deseret from 1894 to 1897. From 1897 to 1907, Talmage was a professor of geology at the University of Utah.

Elder Talmage was elected to life membership in several learned societies, and for many years was a Fellow of the Royal Microscopical Society (London), Fellow of the Royal Scottish Geographical Society (Edinburgh), Fellow of the Geological Society (London), Fellow of the Geological Society of America, Fellow of the Royal Society of Edinburgh, Associate of the Philosophical Society of Great Britain, or Victoria Institute, and Fellow of the American Association for the Advancement of Science.

In addition to science textbooks, Elder Talmage was the author of several well-known religious books, including *The Articles of Faith*, *The Great Apostasy*, *The House of the Lord*, and *Jesus the Christ*.

Elder Talmage married Merry May Booth (1868–1944) on June 14, 1888. The Talmages had eight children. Among their children was John Talmage, who wrote a biography of his father. Another of their children, Sterling B. Talmage (1889–1956), followed his father's interests and became a geologist.





# JOHN W. WELCH



John W. (Jack) Welch is the Robert K. Thomas Professor of Law at the J. Reuben Clark Law School, where he teaches a variety of courses on tax exempt organizations, ancient laws in the Bible and Book of Mormon, and Joseph Smith and the law. He was educated at Brigham Young University with a B.A. in History, minor in Mathematics, and M.A. in Classical Languages (1970). He filled a Latter-day Saint mission in South Germany (during which time he discovered chiasmus in the Book of Mormon), studied Greek philosophy at Oxford University (1970-72), served on the Duke Law Journal and earned his law degree at Duke University (1972-75), and practiced tax law in the Los Angeles firm of O'Melveny and Myers (1975-1980), before joining the faculty at BYU.

He is well known as the founder of FARMS (the Foundation for Ancient Research and Mormon Studies), and since 1991, as the editor-in-chief of *BYU Studies Quarterly*, the leading interdisciplinary journal at BYU. He also has served as the general editor of the *Collected Works of Hugh Nibley*, as a member of the Jewish Law Association, and on the board of editors for Macmillan's *Encyclopedia of Mormonism*. He was the Distinguished Faculty Lecturer at BYU in 2010.

He has authored or edited a number of books and articles, including *The Sermon on the Mount in the Light of the Temple* (London: Ashgate, 2009); *The Legal Cases in the Book of Mormon* (Provo: FARMS, 2008), and *Sustaining the Law: Joseph Smith's Legal Encounters* (Provo: BYU Studies, 2014). In other notable works, he has analyzed the hidden allegorical meanings in the parable of the Good Samaritan, the legal elements of fear and miracles in the trials of Jesus, the expanding mind, the foundations of jurisprudence, the conjunction of rights and duties, and the role of evidence in the nurturing of faith.

He is married to Jeannie Sutton, who recently retired from the French Department at Brigham Young University. They have four children and seventeen grandchildren. Together they enjoy traveling, teaching, family activities, the arts, and church service in ward, stake, and temple capacities.



# AMY L. WILLIAMS



Amy L. Williams is a Nancy and Peter Meinig Family Investigator in Life Science and Technology and Assistant Professor of Computational Biology at Cornell University. Amy grew up in a suburb of Salt Lake City and was raised as a member of The Church of Jesus Christ of Latter-day Saints. Her exposure to the Church led her to seek knowledge of God's existence directly from God and to explore questions relating to religion through prayer. These experiences have convinced her that knowledge of God can be had by following a methodological process proposed in the Book of Mormon. Through her interactions with peers during her academic training, Amy has engaged in discussions of belief in God with many atheists and agnostics. Because of her own experience with God and these discussions, she has become interested in communicating the view that belief in God can be obtained by direct interaction with God's Spirit.

Amy earned dual Bachelor of Science degrees in Computer Science and Mathematics from the University of Utah in 2003. She did graduate work at Massachusetts Institute of Technology where she received a Master of Science in 2005 and Ph.D. in 2010. Her thesis research focused on the development of a highly efficient algorithm for inferring the transmission of alleles from parents to children using genotype data from nuclear families.

From 2009-2013, Dr. Williams was a postdoctoral research fellow at Harvard Medical School where she continued her research on efficient computational techniques for modeling and inferring genetic variation and performed research on the genetics of type 2 diabetes in Latinos. From 2013-2014 she continued her research as a postdoctoral associate at Columbia University. She joined the faculty at Cornell University in the fall of 2014. Her research interests focus on human genetics and span the intersection of computer science and genetics. Key focus areas of her work include characterizing the forces that promote genetic variation as well as the development of computational techniques for modeling and performing inference on genetic variation in large scale genetic datasets.



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Reference: 246917338; **2:** *Eighteenth-Century Chemical Laboratory in Paris, Showing Instruments, Furnaces, Chemical Vessels, and Chemists*, ca. 1760. Alchemical symbols are arranged below in a kind of proto-periodic table. From Denis Diderot, *Encyclopedie ou Dictionnaire raisonné des sciences, des arts et des métiers*, 1751-1772. © 2015 Photo Researchers, Inc. All Rights Reserved. Science Source Image Number: JB3616, with special thanks to Peter Pagan; **3:** *Orrery, Made by Newton and Company*. London, early 19th century. Brass. English School. Private Collection / Bridgeman Images. Image Reference: MFR 135761, with special thanks to Wendy Zieger; **4:** *Graphite and Diamonds*. Left: Rough piece of carbon rock mineral in the form of graphite. © Anneka. Anneka / Shutterstock. Image Reference: 121608052; Right: Loose diamond parcel on black background. © Avprophoto. Avprophoto / Shutterstock. Image Reference: 89497015; **5:** *The Divine Cosmographer*, 1640. William Hodson, active 1625-1640. Captioned: "The divine cosmographer; or, A brief survey of the whole world, delineated in a tractate on the VIII Psalm: by William Hodson sometime of St. Peters College in Cambridge." Printed by Roger Daniel, printer to the University of Cambridge, 1640. William Hodson (active 1625-1640) was an English theological writer. He was educated at Peterhouse, Cambridge, and graduated B.A. in 1620, M.A. in 1624. © 2015 Photo Researchers, Inc. All Rights Reserved. Folger Shakespeare Library / Photo Researchers, Inc. Science Source Image Number: JC0242, with special thanks to Peter Pagan; **5:** *Austrian Logician, Mathematician and Philosopher, Kurt Friedrich Gödel, 1906-1978*. Kurt Friedrich Gödel (1906-1978) was an Austrian logician, mathematician and philosopher. Later in his life he emigrated to the United States to escape the effects of World War II. One of the most significant logicians of all time, Gödel made an immense impact upon scientific and philosophical thinking in the 20th century. Gödel is best known for his two incompleteness theorems, published in 1931 when he was 25 years old. To prove this theorem, Gödel developed a technique now known as Gödel numbering, which codes formal expressions as natural numbers. He also made important contributions to proof theory by clarifying the connections between classical logic, intuitionistic logic, and modal logic. Images and Text © 2015 Photo Researchers, Inc. All Rights Reserved. New York Public Library / Science Source. Science Source Image Number: BT8608, with special thanks to Peter Pagan; **6:** *Artwork Depicting Star Formation*. Artwork depicting a star forming. John R. Foster / Science Source. Science Source Image Number: 2X3369; **7:** *Image of business partners hands on top of each other symbolizing companionship and unity*. © Pressmaster. Pressmaster / Shutterstock. Image Reference: 153389081; **8:** *Romantic couple holding hands and watching a beautiful sunset*. © KieferPix. KieferPix / Shutterstock. Image Reference: 178191263; **9:** Left: *Ezra Taft Benson Building, home of the BYU Department of Chemistry and Biochemistry*; Right: *Joseph Smith Building, home of the BYU College of Religious Education*. Photograph by John W. Welch, IMG\_1246, 30 November 2015.

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**Amy L. Williams, Answering New Atheism and Seeking a Sure Knowledge of God. 1:** *Sky with clouds and sun*. © sayhmog. sayhmog / Shutterstock. Image Reference: 114711289; **2:** *Close up of female scientist looking to microscope in clinical laboratory over hydrogen chemical formula and DNA molecule structure*. © Syda Productions. Syda Productions / Shutterstock. Image Reference: 285993866; **3:** *Conceptual Representation of the Multiverse Hypothesis*. Multiverse layers, artwork. The multiverse,

also called the meta-universe or metaverse, is the hypothetical set of possible universes, and includes all of space and time, and all forms of matter and energy, and also other forms of the laws of nature. Here, the multiverse consists of layers or membranes (M-theory). On the surface of each layer are the galaxies and nebulae in each universe. Images and Text © 2015 Photo Researchers, Inc. All Rights Reserved. Victor de Schwanberg / Science Source. Science Source Image Number: SQ8386; **4:** *A road sign with “Faith” on sky background.* © Jane0606. Jane0606 / Shutterstock. Image Reference: 205415146; **5:** *Roger Bacon (1214-1294) Conducts an Experiment.* Colorized from an engraving in Michael Maier, *Symbola aureae*, 1617. Engraving from Michael Maier (1568?-1622), *Symbola aureae mensae duodecim nationum* (Frankfurt: typis A. Hummij, impensis Lucæ Iennis, 1617) showing Roger Bacon conducting an experiment. Roger Bacon (1214-1294) was an English philosopher and Franciscan friar who placed considerable emphasis on the study of nature through empirical methods. Library of Congress Call Number: QD25.M2 S9 1617 (Office) (General Collections), <http://www.loc.gov/pictures/item/2006681058/> (accessed 26 December 2015). Images and Text Copyright © 2015 Photo Researchers, Inc. All Rights Reserved. Library of Congress / Science Source. Science Source Image Number: BW7233; **6:** *The Desires of My Heart*, 2004. Walter Rane (1949-). <http://www.walterraneprints.com/prints/the-desires-of-my-heart>. By permission of the artist, with special thanks to Linda Rane; **7:** *A photograph of the 1841 First European (London) edition of the Book of Mormon, at the Springs Preserve Museum, Las Vegas, Nevada.* Photograph by Prosfilas, 2012. [https://commons.wikimedia.org/wiki/File:1841\\_Book\\_of\\_Mormon\\_open\\_to\\_title\\_page.jpg](https://commons.wikimedia.org/wiki/File:1841_Book_of_Mormon_open_to_title_page.jpg) (accessed 26 December 2015). Public Domain.

**Jeffrey M. Bradshaw, *Science and Genesis: A Personal View*.** **1:** *Donald Duck Gathers the Animals to the Ark*, 1999. From Fantasia 2000, © The Walt Disney Company; [http://disney.wikia.com/wiki/Donald\\_Duck](http://disney.wikia.com/wiki/Donald_Duck) (accessed September 24, 2013); **2:** *In Search of Noah’s Ark*, 1976. © Clear Channel Communications, Inc. for Shick Sunn Classic Pictures; **3:** *Enki Inserts a Computer Disk.* <http://enkispeaks.com/2012/08/28/galzu-saved-earthlings-from-flood-book-of-enki-tablet-6-sitchin-youtubes-lessin-article/> (accessed September 21, 2013); **4:** *Russell Crowe as Noah.* <http://beforeitsnews.com/religion/2013/01/russell-crowes-noah-film-a-warning-for-christians-2447702.html> (accessed June 17, 2013); Publicity still from Noah, © Paramount Pictures; **5:** *A “Watcher” on the Attack.* <http://www.zekefilm.org/2012/07/12/the-beginning-is-the-end-is-the-beginning/> (accessed September 21, 2013). Cover from Darren Aronofsky and Niko Henrichon, *Noah*, vol. 2. © Lombard; **6:** Adapted from Jean-Leon Gerome, 1824-1904: *Dante and Virgil in Hell*, 1850. [http://commons.wikimedia.org/wiki/Category:Jean-L%C3%A9on\\_G%C3%A9r%C3%B4me](http://commons.wikimedia.org/wiki/Category:Jean-L%C3%A9on_G%C3%A9r%C3%B4me) (accessed November 3, 2013); **6:** *Carl Sagan, 1934-1996.* [https://en.wikipedia.org/wiki/File:Carl\\_Sagan\\_Planetary\\_Society.JPG](https://en.wikipedia.org/wiki/File:Carl_Sagan_Planetary_Society.JPG) (accessed October 23, 2015); **7:** *Elder Neal A. Maxwell, 1926-2004.* Deseret News. <http://www.deseretnews.com/article/700164271/Remembering-clear-words-of-Elder-Maxwell.html?pg=all> (accessed October 23, 2015); **8:** *Joseph Smith, Jr., 1804-1844.* [http://upload.wikimedia.org/wikipedia/commons/8/86/Joseph\\_Smith%2C\\_Jr.\\_portrait\\_owned\\_by\\_Joseph\\_Smith\\_III.jpg](http://upload.wikimedia.org/wikipedia/commons/8/86/Joseph_Smith%2C_Jr._portrait_owned_by_Joseph_Smith_III.jpg) (accessed February 3, 2012). Painting by an unknown painter, circa 1842. The original is owned by the Community of Christ archives. It is on display at the Community of Christ headquarters in Independence, Missouri, where its provenance is explained. The painting was originally in the possession of Joseph Smith III (1832-1914), who is recorded as commenting on the painting. The ca. 1842 date is given by the Community of Christ, the painting’s owner; **9:** Noël Pissano: *Negative of Hand and Red Dots*, Cavern of Pech-Merle, Cabarets, France, ca. 2004. From an original plate in the possession of the author; **10:** *Seven Hands*, Cavern of Pech-Merle, Cabarets, France. In Clottes, Jean. *L’Art des Cavernes*. Paris, France: Phaidon, 2008, p. 102; **11:** Fernand-Anne Piestre (Cormon), 1845-1924: *Cain, Based on Victor Hugo’s Poem*, 1880. Permission granted from the Musée d’Orsay, Paris, France; **12:** Thomas Cole, 1801-1848: *The Subsiding Waters of the Deluge*, 1829. [http://commons.wikimedia.org/wiki/File:Cole\\_Thomas\\_The\\_Subsideing\\_of\\_the\\_Waters\\_of\\_the\\_Deluge\\_1829.jpg](http://commons.wikimedia.org/wiki/File:Cole_Thomas_The_Subsideing_of_the_Waters_of_the_Deluge_1829.jpg) (accessed September 20, 2013); **13:** Joseph Brickey, 1973-: *Lehi Studying the Brass Plates*, 2005. By permission of the artist, with special thanks to Angela Brickey; **14:** *Joseph Smith, Prophet and Seer*, 2011. Dustin Harding as Joseph Smith. From *Joseph Smith - Volume 1: Plates of Gold*, a film by Christian Vuissa. Photograph by Mirror Films. [http://www.heraldextra.com/lifestyles/shining-testament-new-film-about-the-life-of-joseph-smith/article\\_d7639ffc-e664-11e0-bd81-001cc4c03286.html](http://www.heraldextra.com/lifestyles/shining-testament-new-film-about-the-life-of-joseph-smith/article_d7639ffc-e664-11e0-bd81-001cc4c03286.html) (accessed 21 December

2015); **15**: Adapted from Michael B. Lyon, 1952-: *Sacred Topography of Eden and the Israelite Temple*. Illustration courtesy of the artist; **16**: Michael B. Lyon, 1952-: *Sacred Topography of Eden and the Israelite Temple*. Illustration courtesy of the artist; **17**: *Zones of Sacredness in the Garden of Eden and the Temple*. © Jeffrey M. Bradshaw. Compare G. A. Anderson, *Perfection*, p. 80; **18**: *Enoch Window at Canterbury Cathedral*, ca. 1178-1180. Bridgeman Images. Image Reference: XPC 345035; **19**: *The Hanging Gardens of Babylon (Tower of Babel in the Distance)*, 1959-1962. Mario Larrinaga, 1895-1972. With the permission of Ancient Wonders, Inc. and Don Lademann; **20**: *Enoch*, Creation Window, All Saints Church, Selsley, England, 1861. George Campfield, fl. 1861. Bridgeman Images. Image Reference: MOK 120180; **21**: J. James Tissot, 1836-1902: *Building the Tower of Babel*, ca. 1896-1902. The Jewish Museum, New York/Art Resource, NY. Image Reference: ART8303, with the assistance of Liz Kurtulik Mercuri; **22**: *Henry Eyring (1901-1981) (at the Blackboard)*, 1958. Published in Eaton, Robert I., and Henry J. Eyring. *I Will Lead You Along: The Life of Henry B. Eyring*. Salt Lake City, UT: Deseret Book, 2013, p. 49. Special Collections Department, J. Willard Marriott Library, University of Utah. Image Reference: P0250n01\_02\_084b. Special thanks to Margaret Benson, Sara Caroline Davis, and Bill Miller.

**Jeffrey M. Bradshaw, Frequently Asked Questions about Science and Genesis.1: Tower of Babel**, 1928. M. C. Escher, 1898-1972. Public Domain: <http://uploads4.wikipaintings.org/images/m-c-escher/tower-of-babel.jpg> (accessed September 20, 2013); **2: Light and Color: The Morning After the Deluge (Goethe's Theory) - Moses Writing the Book of Genesis**, 1843. Joseph Mallord William Turner, 1775-1851. Tate Gallery, London 2013. Image Reference: N00532; **3: Moses Seeing Jehovah**, 1998. Joseph Brickey, 1973-. By permission of the artist, with special thanks to Angela Brickey; **4: Joseph Smith, Jr. to William W. Phelps**, 31 July 1832. <http://josephsmithpapers.org/paperSummary/letter-to-william-w-phelps-31-july-1832> (accessed 24 December 2015); **5: Abstract No 78 — Creatio Ex Nihilo**, 2015. Radu Gavrilă, 1977-. The image is a digitally manipulated fragment from the original, which is oil on canvas named *Creatio Ex Nihilo No 2*, painted in 2015. By permission of the artist. <http://fineartamerica.com/featured/abstract-no-78-creatio-ex-nihilo-radu-gavrila.html> (accessed 24 December 2015); **6: The Creation of Light**, 1913. Gaetano Previati, 1852-1920. Rome, Galleria nazionale d'arte moderna e contemporanea. Ministero per i Beni e le Attività Culturali, and assistance from Chiara Mutti. Thanks also to Studio Fotografico, with the assistance of Giuseppe Schiavinotto; **7: The Second Day of Creation**, 1925. M. C. Escher, 1898-1972. Public Domain. <http://www.wikiart.org/en/m-c-escher/the-2nd-day-of-the-creation> (accessed 26 December 2015); **8: The Garden of Eden**, ca. 1828. Thomas Cole, 1801-1848. Public Domain. [https://en.wikipedia.org/wiki/Garden\\_of\\_Eden#/media/File:Cole\\_Thomas\\_The\\_Garden\\_of\\_Eden\\_1828.jpg](https://en.wikipedia.org/wiki/Garden_of_Eden#/media/File:Cole_Thomas_The_Garden_of_Eden_1828.jpg) (accessed 26 December 2015); **9: "There Went Up a Mist from the Earth,"** 2011, Ignasi Montserrat i Quevedo. <https://www.flickr.com/photos/41715152@N03/6432726867/> (accessed 24 December 2015); **10: Adam and Eve Outside Paradise, Cain and Abel**, 12th century. Biblioteca Apostolica Vaticana. From a 12th century illuminated version of the *Homilies of James of Kokkinobaphos from Byzantium* (Vat. gr. 1162, fol. 35v.); **11: Adam's Peak**, 1780. From Antoine-François Prévost, *Voïages*, vol. 8. Public Domain. <http://www.columbiauniversity.org/itc/mealac/pritchett/00generallinks/prevost/southasia/zadamspeakceylon.jpg> (accessed 26 December 2015); **12: Harold B. Lee**, 1899-1973. *The Daily Herald*. Article: [http://www.heraldextra.com/lifestyles/faith-and-values/lds-week/fall2013/harold-b-lee-strengthens-church-welfare-system/article\\_d7553aac-2622-11e3-b9bf-0019bb2963f4.html](http://www.heraldextra.com/lifestyles/faith-and-values/lds-week/fall2013/harold-b-lee-strengthens-church-welfare-system/article_d7553aac-2622-11e3-b9bf-0019bb2963f4.html). Photograph: <http://bloximages.chicago2.vip.townnews.com/heraldextra.com/content/tncms/assets/v3/editorial/2/95/29560274-2857-11e3-8cdc-001a4bcf887a/5246fd3975671.preview-620.jpg> (accessed 24 December 2015); **13: James E. Talmage**, 1862-1933. BYU Religious Studies Center: <https://rsc.byu.edu/sites/default/files/TRE%203talmage.jpg> (accessed 24 December 2015); **14: Harvey Fletcher**, 1884-1981. [http://www.et.byu.edu/~tom/family/Harvey\\_Fletcher/harvey\\_fletcher.html&h=1010&w=800&tbnid=HqY7UJjw-RVFEM:&docid=fbZdfLAgDRSc\\_M&ei=s07VoumNcG5-AHw1I-4BQ&tbn=isch&client=safari&ved=0CBwQMygAMABqFQoTCIuLhd6g-sgCFcEcPgdcOoDVw](http://www.et.byu.edu/~tom/family/Harvey_Fletcher/harvey_fletcher.html&h=1010&w=800&tbnid=HqY7UJjw-RVFEM:&docid=fbZdfLAgDRSc_M&ei=s07VoumNcG5-AHw1I-4BQ&tbn=isch&client=safari&ved=0CBwQMygAMABqFQoTCIuLhd6g-sgCFcEcPgdcOoDVw) (accessed 24 December 2015); **15: The Great High Priest**, 2015. Benjamin Pack, 1985-. Pack writes ([http://benpackillustration.blogspot.com/2015/06/the-great-high-priest\\_14.html](http://benpackillustration.blogspot.com/2015/06/the-great-high-priest_14.html) (accessed 26 December 2015)): "The main idea behind this painting was Christ as the Great High Priest, Paul names Him as such in Hebrews 5. On the Day of Atonement, the high priest



would go into the tabernacle or temple and into the Holy of Holies, he would sprinkle the blood of beasts onto the Ark of the Covenant (Mercy Seat) to redeem the sins of Israel. Christ acting as Great High Priest lays down His life and sheds His own blood, that we might be worthy to be brought back into God's Presence." In an email message to Jeffrey M. Bradshaw on March 1, 2015, the artist alluded to traditions about the possibility of three special trees in the Garden of Eden that were discussed in a FairMormon presentation entitled "The Message of the Joseph Smith Translation: A Walk in the Garden." He wrote: "I have represented the Tree of Knowledge as gates that we pass through upon coming to earth, in our path to eternal life. I use the fig tree for its depiction. Then I represented Christ as the Great High Priest, who spills His blood on the Mercy Seat to atone for our sins, overcoming the negative effects of the Fall. The Tree of Life or Tree of Atonement is behind Him shown as an olive tree, representing Him and His Atonement. Lastly I have the original Tree of Life or Eternal Life depicted as a date palm on the top with the exalted couple, showing what we can attain to if we follow God's plan."; **16:** *The Creation of Eve*, 1510. Michelangelo Buonarroti, 1475-1564. Detail from the Sistine Chapel fresco. <http://www.michelangelo.org/images/artworks/creation-of-eve.jpg> (accessed 24 December 2015); **17:** *Plate from The Song of Los, copy B* (1795). William Blake, 1757-1827. Public Domain: [https://commons.wikimedia.org/wiki/File:William\\_Blake\\_-\\_Sconfitta\\_-\\_Frontispiece\\_to\\_The\\_Song\\_of\\_Los.jpg](https://commons.wikimedia.org/wiki/File:William_Blake_-_Sconfitta_-_Frontispiece_to_The_Song_of_Los.jpg); **18:** *The Evening of the Deluge*, ca. 1843. Joseph Mallord William Turner, 1775-1851. Timken Collection - 1960.6.40, National Gallery of Art, Washington DC; **19:** *The Ark and Its Occupants*, from the Beatus of Santo Domingo de Silos (Silos Apocalypse), 1109. Petrus. © The British Library Board. Source: Add. 11695, f.79v. British Library Images Online; **20:** *Family Tree of the Indo-European Languages*, 2005. Katharine Scarfe Beckett, 1972-. © Katharine Scarfe Beckett; **21:** *Family Tree of the Semitic Languages*, 2005. Katharine Scarfe Beckett, 1972-. © Katharine Scarfe Beckett.

**John S. Lewis, *The Scale of Creation in Space and Time*. 1:** *Birth of a Solar System*. Protoplanetary disk. © Mopic. Mopic / Shutterstock. Image Reference: 15581773; **2:** *Fantastic Depiction of the Solar System*, German School, 19th century, colorized. Woodcut. Private Collection / Bridgeman Images. Image Reference: XCF 209212, with special thanks to Wendy Zieger; **3:** *Bust of Aristotle*, 384-322 BC. *Bust of Greek Philosopher Aristotle Isolated on Black Background*. © MidoSemsem. MidoSemsem / Shutterstock. Image Reference: 202409776; **4:** *Photo Montage of Isis Temple at Philae Island and a Star-Birthing Region in the Orion Nebula*. Elements of this image furnished by NASA. © Xavier Fargas. Xavier Fargas / Shutterstock. Image Reference: 232279327; **5:** *Photo Montage of the Hubble Space Telescope Observing Deep Space While Orbiting the Earth*. Elements of the image furnished by NASA. © MarcelClemens. MarcelClemens / Shutterstock. Image Reference: 180826445.

**Ron Hellings, Joseph Smith and Modern Cosmology. 1:** *Result from the Bolshoi Simulation of Structure Formation in a Universe with Dark Matter and Dark Energy*. Sources: Simulation, Anatoly Klypin and Joel R. Primack; Visualization, Stefan Gottlöber/Leibniz Institute for Astrophysics Potsdam. Published in Joel R. Primack (originally published as "The Universe in a Supercomputer"), *IEEE Spectrum* (1 October 2012), <http://spectrum.ieee.org/aerospace/astrophysics/the-cosmological-supercomputer> (accessed 26 December 2015). See also <http://hipacc.ucsc.edu/Bolshoi/index.html> (accessed 26 December 2015); **2:** *Maxwell's Equations Mug*. Light is a form of electromagnetic radiation. [http://www.cafepress.com/mf/18668606/maxwells-equations\\_mugs](http://www.cafepress.com/mf/18668606/maxwells-equations_mugs) (accessed 26 December 2015); **3-5:** Figures adapted by Kelsey Avery from original artwork by Ron Hellings; **6:** *The Hubble Relation*. Galactic redshifts demonstrating that the velocity of a galaxy is proportional to its distance. Original courtesy of The Observatories of the Carnegie Institution of Washington, adapted by Ron Hellings; **7-24:** Figures adapted by Kelsey Avery from original artwork by Ron Hellings.

**Jani Radebaugh, *The Outer Solar System: A Window to the Creative Breadth of Divinity*. 1:** *Perspective View of the 1813 Orrery*, 1830. William Pearson (1767-1847). Drawing of orrery built in 1813 by British astronomer Dr. William Pearson. The lower drawing is a section through the axis, showing the mechanism. In addition to the planets and their moons, it also showed the asteroids Ceres, Vesta, and Pallas. Source: Planetary Machines, *Edinburgh Encyclopaedia*, Vol.16, 1830, William

Blackwood & Proprietors, Edinburgh UK, Plate 462, following p. 741, [https://books.google.com/books/about/The\\_Edinburgh\\_Encyclopaedia.html?id=2fAmcjoM92sC](https://books.google.com/books/about/The_Edinburgh_Encyclopaedia.html?id=2fAmcjoM92sC). Public Domain. [https://commons.wikimedia.org/wiki/File:William\\_Pearson\\_Orrery.png](https://commons.wikimedia.org/wiki/File:William_Pearson_Orrery.png) (accessed 26 December 2015); **2:** *Photograph of the Moon from an Apollo mission*. From Jani Radebaugh, courtesy of NASA; **3:** *Large, rayed crater on Mercury imaged by the MESSENGER spacecraft*. From Jani Radebaugh, courtesy of NASA; **3:** *Surface and atmosphere of Mars*. From Jani Radebaugh, courtesy of NASA; **4:** *Jupiter and moon Io taken by the Pioneer 11 spacecraft*. From Jani Radebaugh, courtesy of NASA; **5:** *Jupiter from the New Horizons spacecraft*. From Jani Radebaugh, courtesy of NASA; **6:** *This “family portrait,” a composite of the Jovian system, includes the edge of Jupiter with its Great Red Spot, and Jupiter’s four largest moons, known as the Galilean satellites. From top to bottom, the moons shown are Io, Europa, Ganymede and Callisto*. From Jani Radebaugh, courtesy of NASA; **7:** *Image of impact craters across Jupiter’s moon Callisto from the Galileo spacecraft*. From Jani Radebaugh, courtesy of NASA; **8:** *Jupiter’s moon Europa from the Galileo spacecraft, enhanced to reveal the salts emerging from giant cracks across the surface*. From Jani Radebaugh, courtesy of NASA; **9:** *Closeup of the surface of Europa, with fractured ice blocks, from the Galileo spacecraft*. From Jani Radebaugh, courtesy of NASA; **10:** *Cassini spacecraft image of Io and Jupiter*. From Jani Radebaugh, courtesy of NASA; **11:** *Voyager spacecraft image of Io, with volcanic gases and dust illuminated by sunlight above the limb*. From Jani Radebaugh, courtesy of NASA; **12:** *Galileo spacecraft image of Io, with blues slightly enhanced from true color. Hundreds of volcanoes cover the surface*. From Jani Radebaugh, courtesy of NASA; **13:** *Picture from Hawaii*. Photograph by Jani Radebaugh; **14:** *Simulated view of Jupiter from the surface of Io*. <http://leveloni.blogspot.com/2013/09/curiosidades-del-sistema-solar.html> (accessed 26 December 2015); **15:** *Image of Saturn taken by the Cassini spacecraft*. From Jani Radebaugh, courtesy of NASA/JPL; **16:** *Artist’s rendition of the Cassini spacecraft in orbit around Saturn*. From Jani Radebaugh, courtesy of NASA/JPL; **17:** *Image mosaic of Saturn and the ring system taken by the Cassini spacecraft. The Earth and Moon can be seen in the upper left corner*. From Jani Radebaugh, courtesy of NASA/JPL; **18:** *Saturn with the ring plane, moon Enceladus, and ring shadows cast onto the surface*. From Jani Radebaugh, courtesy of NASA/JPL; **19:** *The limb of Enceladus from the Cassini spacecraft*. From Jani Radebaugh, courtesy of NASA/JPL; **20:** *Backlit view of the geysers of Enceladus, taken by the Cassini spacecraft*. From Jani Radebaugh, courtesy of NASA/JPL; **21:** *Photo montage of Saturn’s moon Mimas and giant crater Herschel, with the Millennium Falcon on approach*. From Jani Radebaugh, courtesy of NASA/JPL and Lucasfilm; **22:** *Voyager spacecraft image of Titan*. From Jani Radebaugh, courtesy of NASA/JPL; **23:** *Artist’s rendition of a possible Titan with the Huygens probe descending*. From Jani Radebaugh, courtesy of NASA/JPL; **24:** *Huygens DISR image of the surface of Titan from above (left) and from the surface (right)*. From Jani Radebaugh, courtesy of NASA/UA/JPL; **25:** *Titan North Polar Lakes*. The mosaic combines radar swaths seen on several Titan passes: July 22, 2006 (T16); Sept. 23, 2006 (T18); Oct. 9, 2006 (T19); and Feb. 22, 2007 (T25), respectively. Public Domain. [https://commons.wikimedia.org/wiki/File:PIA09183\\_Titan\\_north\\_polar\\_lakes.jpg](https://commons.wikimedia.org/wiki/File:PIA09183_Titan_north_polar_lakes.jpg) (accessed 26 December 2015). See also <http://photojournal.jpl.nasa.gov/catalog/PIA09183>. Courtesy of NASA/JPL-Caltech/Italian Space Agency; **26:** *Artist’s rendition of a methane sea on Titan, with Saturn in the background*. From Jani Radebaugh, courtesy of NASA; **27:** *Cassini RADAR image of the Belet Sand Sea. Dunes are dark because they absorb the RADAR signal*. From Jani Radebaugh, courtesy of NASA/JPL; **28:** *Artist’s rendition of a drone landing in a sand sea on Titan*. Painting by Michael Carroll, with permission; **29:** *Saturn: North Polar Hexagon and Vortex with Rings, 2 April 2014*. The view was obtained by the Cassini spacecraft at a distance of approximately 1.4 million miles (2.2 million kilometers) from Saturn and at a Sun-Saturn-spacecraft, or phase, angle of 43 degrees. Image scale is 81 miles (131 kilometers) per pixel. Public Domain. [https://en.m.wikipedia.org/wiki/Saturn%27s\\_hexagon#/media/File:3APIA18274-Saturn-NorthPolarHexagon-Cassini-20140402.jpg](https://en.m.wikipedia.org/wiki/Saturn%27s_hexagon#/media/File:3APIA18274-Saturn-NorthPolarHexagon-Cassini-20140402.jpg) (accessed 26 December 2015); **30:** *Image of Uranus from the Voyager spacecraft*. From Jani Radebaugh, courtesy of NASA/JPL; **31:** *Photo Montage of Uranus and its largest satellites, taken by the Voyager spacecraft*. From Jani Radebaugh, courtesy of NASA/JPL; **32:** *Image of Neptune from the Voyager spacecraft*. From Jani Radebaugh, courtesy of NASA/JPL; **33:** *Voyager spacecraft image of Neptune’s largest satellite Triton, thought to be much like Pluto*. From Jani Radebaugh, courtesy of NASA/JPL.

**Bart J. Kowallis, *From All Eternity to All Eternity: Deep Time and the Gospel*. 1:** *Carina Nebula As Seen from the Hubble Space Telescope*, 2010. HH 901, HH 902. Public Domain. This billowing cloud of cold interstellar gas and dust rising from a tempestuous stellar nursery located in the Carina Nebula, 7500 light-years away in the southern constellation of Carina. This pillar of dust and gas serves as an incubator for new stars and is teeming with new star-forming activity. In the process of star formation, a disc around the proto-star slowly accretes onto the star's surface. Part of the material is ejected along jets perpendicular to the accretion disc. The jets have speeds of several hundreds of miles per second. As these jets plough into the surrounding nebula, they create small, glowing patches of nebulosity, called Herbig-Haro (HH) objects. Long streamers of gas can be seen shooting in opposite directions off the pedestal on the upper right-hand side of the image. Another pair of jets is visible in a peak near the top-center of the image. These jets (known as HH 901 and HH 902, respectively) are common signatures of the births of new stars. Hubble's Wide Field Camera 3 observed the pillar on 1-2 February 2010. The colors in this composite image correspond to the glow of oxygen (blue), hydrogen and nitrogen (green) and sulphur (red). News Release Number: STScI-2010-13. NASA, ESA, and M. Livio and the Hubble 20th Anniversary Team (STScI). <https://www.spacetelescope.org/images/heic1007e/> (accessed 26 December 2015); **2:** *James Hutton, 1726 - 1797. Geologist*, 1776, Henry Raeburn (1756–1823). Oil on Canvas. Public Domain. Scottish National Gallery. Accession number: PG 2686. [https://commons.wikimedia.org/wiki/File:Sir\\_Henry\\_Raeburn\\_-\\_James\\_Hutton,\\_1726\\_-\\_1797\\_Geologist\\_-\\_Google\\_Art\\_Project.jpg](https://commons.wikimedia.org/wiki/File:Sir_Henry_Raeburn_-_James_Hutton,_1726_-_1797_Geologist_-_Google_Art_Project.jpg) (accessed 26 December 2015); **3:** *Rewriting the Law of Gravity*, 2012, John Cole. *The Scranton Times-Tribune*. CagleCartoons.com; **4:** *Artist's Conception of Planets Over the Nebulae in Space*. © Vadim Sadovskii. Vadim Sadovskii / Shutterstock. Image Reference: 125922590; **5:** *Artist's Conception of Earth with Rising Sun and Asteroid Belt*. Elements of this image furnished by NASA. © Rashevskiy Vlacheslav. Rashevskiy Vlacheslav / Shutterstock. Image Reference: 108122204; **6-7:** Figures adapted by Kelsey Avery from original artwork by Bart J. Kowallis.

**James E. Talmage, *The Earth and Man*. 1:** *The Creation: Sun, Moon, Stars, Earth*, 15th century. Great Malvern Priory, Window S2, Worcestershire, UK. Stained Glass. English School. Great Malvern Priory, Worcestershire, UK / Bridgeman Images. Image Reference: PC 720715, with special thanks to Wendy Zieger; **2:** *Fossils Trilobite Imprints in Sediment*. © Merlin74. Merlin74 / Shutterstock. Image Reference: 244788457; **3:** *View of the Orion Nebula from the Hubble Space Telescope*. Orion Nebula, M42, NGC 1976. News Release Number: STScI-2006-01. NASA, ESA, M. Robberto (Space Telescope Science Institute/ESA), and the Hubble Space Telescope Orion Treasury Project Team; **4:** *Skeletons of Australopithecus Boisei and Homo Sapiens*. Pencil on Paper. English School, (20th century). Private Collection / Bridgeman Images. Image Reference: XZL 151552; **5:** *Silhouette of man looking at lake*. © Kochneva Tetyana. Kochneva Tetyana / Shutterstock. Image Reference: 81135547; **6:** *Garden of Eden*, Roelandt Jacobsz Savery, 1576-1639. Faringdon Collection, Buscot, Oxon, UK / Bridgeman Images. Image Reference: BAL 1853, with special thanks to Wendy Zieger; **7:** *View of Galaxy Cluster Abell 520 from the Hubble Space Telescope*. News Release Number: STScI-2012-10. NASA, ESA, CFHT, CXO, M.J. Jee (University of California, Davis), and A. Mahdavi (San Francisco State University); **8:** *Artist's Depiction of Planet Formation*. Rocks as big as mountains swirl around and form a planet in the cosmos. © Catamando. Catamando / Shutterstock. Image Reference: 103031735.

**Steven L. Peck, *Understanding Evolution: An LDS Scientific Perspective*. 1:** *The "Bones" of Lucy*. Plaster Replica of the Bones of Lucy at the National Museum of Ethiopia in Addis Ababa. Photograph provided by Steven L. Peck; **2:** *Adult elephant next to a young elephant*. © Claudia Paulussen. Claudia Paulussen / Shutterstock. Image Reference: 176556266; **3:** *Barnacles and mussels on a rock*. © chbaum. chbaum / Shutterstock. Image Reference: 162832754; **4:** *Drawing of Cat and Dog Spirits*. Photograph provided by Steven L. Peck; **5:** *Chessboard*. Illustration provided by Steven L. Peck; **6:** *Scholar with Devils*. Illustration from *Omne Borum*, 1360-1375, Vellum. English School, 14th century. Royal 6 E. VI, f.535v. British Library, London, UK / Bridgeman Images. Image Reference: BL 1066307; **7:** *Scientist Sketching DNA Structure*. © Wichy. Wichy / Shutterstock. Image Reference: 189666014; **8:** *Mouse trap baited with a large piece of cheddar cheese*. © James.Pintar. James.Pintar / Shutterstock. Image Reference: 261908546.

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**Trent D. Stephens, *Who Is Adam?*** **1:** *Paintings from the Chauvet Cave (Museum Replica)*. Replica of the painting from the Chauvet cave, in the Anthropos museum, Brno. Public Domain. The original art is approximately 31,000 years old, probably Aurignacien. The group of horses probably does not picture a herd of them, but some kind of etiological study, showing, from left to right, calmness, aggression, sleep and grazing. 22 May 2009. HTO. [https://commons.wikimedia.org/wiki/File:Paintings\\_from\\_the\\_Chauvet\\_cave\\_\(museum\\_replica\).jpg](https://commons.wikimedia.org/wiki/File:Paintings_from_the_Chauvet_cave_(museum_replica).jpg) (accessed 26 December 2015); **2:** *Adam and Eve in the Garden of Eden*. Cathedral of St. Michael and St. Gudula, Brussels. Stained Glass. July, 26, 2012. © jorisvo. jorisvo / Shutterstock. Image reference: 12961284; **3:** *Jehovah Creates the Earth*, 2000, Walter Rane (1949-). By permission of the artist, with special thanks to Linda Rane; **4:** *Saint Peter and Saint John Run to the Sepulchre*, 1886-1894, J. James Tissot (1836-1902). *Saint Pierre et Saint Jean courent au sépulcre*. Opaque watercolor over graphite on gray wove paper. Brooklyn Museum, Purchased by public subscription, 00.159.332.

**Emily Bates, R. Paul Evans, Steven L. Peck, Michael R. Stark, Trent D. Stephens, *Life Sciences Panel*.** **1:** *Panel Members. Left to Right: Trent Stephens, Steve Peck, Paul Evans, Emily Bates, and Michael Stark*. Stephen Mayfield, DSC\_0299 (detail), 9 November 2013; **2:** *Stem Cells*. © Loney. Loney / Shutterstock. Image Reference: 237972814; **3:** *DNA Fingerprinting*. © Isak55. Isak55 / Shutterstock. Image Reference: 129482621; **4:** *E Coli Bacteria*. © fusebulb. fusebulb / Shutterstock. Image Reference: 72915928; **5:** *Identical Sheep*. © Jason Benz Bennée. Jason Benz Bennée / Shutterstock. Image Reference: 73158286; **6:** *Identical Twins*. Boy twins. © Hannamariah. Hannamariah / Shutterstock. Image Reference: 267663011; **7:** *James Watson and Francis Crick with a DNA Model*. The discoverers of the structure of DNA. James Watson (b.1928) at left and Francis Crick (b.1916), seen with their model of part of a DNA molecule in 1953. Crick and Watson met at the Cavendish Laboratory, Cambridge, in 1951. Their work on the structure of DNA was performed with a knowledge of Chargaff's ratios of the bases in DNA and some access to the X-ray crystallography of Maurice Wilkins and Rosalind Franklin at King's College London. Combining all of this work led to the deduction that DNA exists as a double helix, thus to its structure. Crick, Watson and Wilkins shared the 1962 Nobel Prize for Physiology or Medicine, Franklin having died of cancer in 1958. Images and Text © 2015 Photo Researchers, Inc. All Rights Reserved. A. Barrington Brown / Science Source. Science Source Image Number: S8129; **8:** *A Baby Girl with an Orthopedic Helmet*. © Darren Brode. Darren Brode / Shutterstock. Image Reference: 75731074; **9:** *Broken Egg Isolated on White Background*. © Nattika. Nattika / Shutterstock. Image Reference: 112438972; **10:** *Scripture Power*. Enhanced photograph by Kelsey Avery.

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